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A. B. CONNER, DIRECTOR
COLLEGE STATION, BRAZOS COUNTY, TEXAS

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DIVISION OF RURAL HOME RESEARCH

Seasonal Variations of Growth in Weight and Height of Texas School Children

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**In cooperation with U. S. Department of Agriculture.
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†As of September 1, 1935

This bulletin reports the seasonal variation of growth in weight and height found among white, Mexican, and negro school children in Texas. It is based upon the records of periodic measurements of approximately 1000 pupils over a period of two and one-half school years.

The average of yearly net gains in weight was 7½ pounds for white children, and 8½ pounds for both Mexican and negro groups. This small race difference is probably due to a slightly larger proportion of older children in the Mexican and negro groups than in the white. The average yearly gain in standing height was about 2 inches, and in sitting height about 1 inch for all races.

Fall was found to be in general the best season for gains in weight by all three races. The relative gains of spring and summer were not consistent between any two of the three races. The summer gains of white children were the lowest of the three races, and those of the negroes the highest; but differences between the races were small. The variation between the three races in seasonal gains suggests that some other factor (or factors) may have a greater influence upon gaining weight than does any natural tendency to gain consistently more in one season than another.

The ratio or gainers to losers was higher in fall than in spring months for all races. An average of approximately three times as many white and Mexican children gained each month of the school year as lost, while only twice as many negroes gained as lost.

The subgroups of each race according to sex, age, birth-month, type of body-build, and certain living conditions, showed essentially the same seasonal variation as did the whole race group. Therefore none of those factors influenced seasonal variation.

October was always a month of excellent growth in weight, the average net gains of the three races ranging from 11.3 per cent to 16.1 per cent of the yearly gains. April was outstanding for poor gains, no more than from 1.4 per cent to 6.4 per cent of the yearly net gains having been made in this month.

No explanation of the excellent gains in October or of the poor gains in April was found in the records of food eaten; nor in the relation of minor illnesses, especially colds, to weight changes; nor in climatic conditions as indicated by records of the U. S. Weather Bureau in San Antonio.

The records of 98 children who at no time showed a loss in weight were examined individually. About two-thirds of them agreed with the trends shown by the average net gains of all the children in that the rate of growth in fall was greater than in either spring or summer. The other one-third had a higher rate of gain in either spring or summer than in fall, showing that good gains can be and often are made in these seasons. This emphasizes the importance of considering each child individually in his course of growth. A child's failure to gain should not be attributed complacently to the season of the year. Too much departure from regularity of gain calls for special attention, although the degree of uniformity to be expected in normal growth must be determined by further study.

Average monthly gains in standing and sitting heights for the three races showed negligible differences between spring-to-fall and fall-to-spring periods. In contrast, weight gains over the same periods were consistently greater in fall-to-spring than in spring-to-fall periods. Apparently the growth in height of these school children was fairly uniform throughout the year, although there may have been marked differences in rate within shorter time intervals than those used in this study.

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BULLETIN NO. 510 SEPTEMBER, 1935

SEASONAL VARIATIONS OF GROWTH IN WEIGHT AND HEIGHT OF TEXAS SCHOOL CHILDREN*

JESSIE WHITACRE

Since the pioneer studies of Bowditch (3) upon the growth of children in Boston public and private schools in 1875-6, interest in growth as an expression of physical well-being has become more widespread until today a health program including some physical measurements of the pupils is a part of most school curricula. The vast amount of attention given more recently to the question of growth was indicated by Scammon (21) who reported to the White House Conference on Child Health and Protection that in the last decade there had appeared over 2000 separate publications pertaining to growth and physique of the child. In this same session of the Conference, Wilson (27) emphasized the necessity of having consecutive measures of growth at successive ages of the same children. Relatively little of the vast accumulation of data on growth is of this individualized kind. Most studies have been of the generalized type wherein a single measurement is made on each member of a large group, and averages are then derived from these single measurements.

One of the questions relating to the usual course of growth in weight and height, upon which available evidence is conflicting, is that of seasonal variation in the rate of growth. Among studies in which seasonal differences have been found in increments to weight and height (5, 6, 7, 9, 10, 11, 13, 16, 18, 19, 25) there is disagreement as to the season of maximum and minimum gains. There is only a meager fund of information respecting the influence of race upon growth processes. This study, of the individualized type, was undertaken with the hope of making a contribution toward answering the questions as to whether seasonal variation occurs in the rate of weight and height increases of school-age children, and whether characteristic and distinctive differences in seasonal rates of growth exist among three race groups†—Mexican, white, and negro —living in the same locality in Texas.

PLAN OF STUDY

Place and Time of Collecting Data

The cooperation of three public schools in San Antonio was secured. These schools were selected by the elementary supervisors as representative of the three races. Collection of data began in January 1929 and was completed in May 1931. Approximately 500 pupils in each of the three schools participated in this study each school year. Except for the last school year, when no first grade pupils were included in this study,

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†The children included in this study, all citizens of the United States, have been classified into three groups, Mexican, other whites, and negroes. As a matter of convenience these groups are referred to as race groups, and for the sake of brevity in this bulletin the designation "white" is used for the second of these groups.

all of the children in the white and negro schools were weighed and measured. In so far as feasible, the same children in the Mexican school were retained in the study during the period of data collection. The white and Mexican children were distributed through the first five grades (elementary school of Texas) and the negroes through the first eight grades (elementary and junior high schools of Texas). Owing to the promotion of some pupils to junior high school and the to the entrance of new pupils in the second year of the study, the total numbers of children appearing in the records were 731, 830, and 981 for negro, Mexican, and white groups, respectively.

Type of Data

The physical measurements of each child were weight, standing height, sitting height, width of hips, and width of shoulders. Other data secured and used for this report include (1) birth date, from which age was calculated; (2) the child's report on each weighing date of any illness since his preceding weighing; (3) a written record of all food eaten by each child for from two to four days within the time of the monthly weighing period in the first one and one-half years of the study, and a similar record confined to third grade children in a fall, a winter, and a spring month of the last year; (4) indications of living conditions—number of adults and of children in the family, total number of rooms in the house, and number of bedrooms and bath rooms—as reported by each child the last year of the study; and (5) a monthly and annual meteorological summary secured from the U. S. Weather Bureau in San Antonio for each month and year covered by this study.

Methods of Collecting Data

Data were collected only during the school year. The detailed schedule of periods within which measurements were made of weight and height, with the intervals between first days of consecutive periods, is given in Table 1. The monthly measuring periods in each school came at approximately the same time of the month. The interval between weighing periods averaged about 30 days. The short November interval in 1929, about three weeks in all schools, should be noted. The longest interval, 42 days (October 1929), and the shortest, 20 days (November 1929), were in the white school. Ideally the weighing intervals should have been perfectly uniform, but such achievement was not practicable since this work was being made to fit into the regular school program. As pointed out later, the variation in the length of intervals appears not to vitiate the conclusions which may be drawn from this study.

Height was measured once each semester (or five times within the period of data collection).

The width of hips and of shoulders was determined once for each of the children and twice for some of them.

The purpose of securing data that would contribute to our more accurate knowledge of the laws of growth influenced the selection of equipment

Table 1. Schedule of measuring periods and number of days* between them

Year	Weight						Height					
	White school		Mexican school		Negro school		White school		Mexican school		Negro school	
	Measuring period	Days since preceding period	Measuring period	Days since preceding period	Measuring period	Days since preceding period	Measuring period	Days since preceding period	Measuring period	Days since preceding period	Measuring period	Days preceding period since
1929					Jan. 15-22						Jan. 15-22	
	Jan. 23-30		Jan. 31-Feb. 4		Feb. 18-26	34	Jan. 23-30		Jan. 31-Feb. 4			
	Feb. 27-Mar. 6	35	Mar. 7-12	35	Mar. 18-25	28						
	Mar. 26-28	26	Apr. 8-10	32	Apr. 11-18	24						
	May 1-3	35	May 6-8	28								
	Oct. 1-11	153	Oct. 14-21	161	Oct. 22-30	194	Oct. 1-11	251	Oct. 14-21	256	Oct. 22-30	280
	Nov. 12-14	42	Nov. 15-19	32	Nov. 20-27	29						
	Dec. 2-4	20	Dec. 9-11	24	Dec. 12-17	21						
1930	Jan. 2-7	31	Jan. 10-15	32	Jan. 20-29	39						
	Feb. 6-11	35	Feb. 12-18	33	Feb. 24-28	35						
	Mar. 3-11	25	Mar. 14-19	30	Mar. 20-25	24	Mar. 3-11	153	Mar. 14-19	151	Mar. 20-Apr. 2	149
	Apr. 3-8	31	Apr. 14-17	31	Apr. 22-30	33						
	May 1-5	28	May 12-14	28	May 19-26	28						
			Sept. 18-23	129	Sept. 24-26	128						
	Sept. 29-30, Oct. 1-8	151	Oct. 13-20	25	Oct. 21-28	27	Sept. 29-30, Oct. 1-8	210	Oct. 13-20	213	Oct. 21-28	215
	Nov. 4-7	36	Nov. 13-18	31	Nov. 19-26	28						
	Dec. 1-5	27	Dec. 10-15	27	Dec. 16-19	27						
1931	Jan. 5-9	35	Jan. 12-16	33	Jan. 19-27	34						
	Feb. 2-5	28	Feb. 16-18	35	Feb. 19-27	31						
	Mar. 3-6	29	Mar. 16-18	28	Mar. 23-27	32						
	Mar. 30-31, Apr. 1-2	27	Apr. 13-17	28	Apr. 20-28	28			Apr. 13-17	182	Apr. 20-28	181
	Apr. 29-30, May 1-4	30	May 18-21	35	May 22-27	32	Apr. 29-30, May 1-4	212				

*Counted from first day of one period to first day of the following period.

and techniques and led to the adoption of certain precautions in the routine procedure.

For weighing, Continental scales of platform type calibrated in ounces were used. A scale was provided for each school. These scales were checked against each other at the outset, and periodically within the time

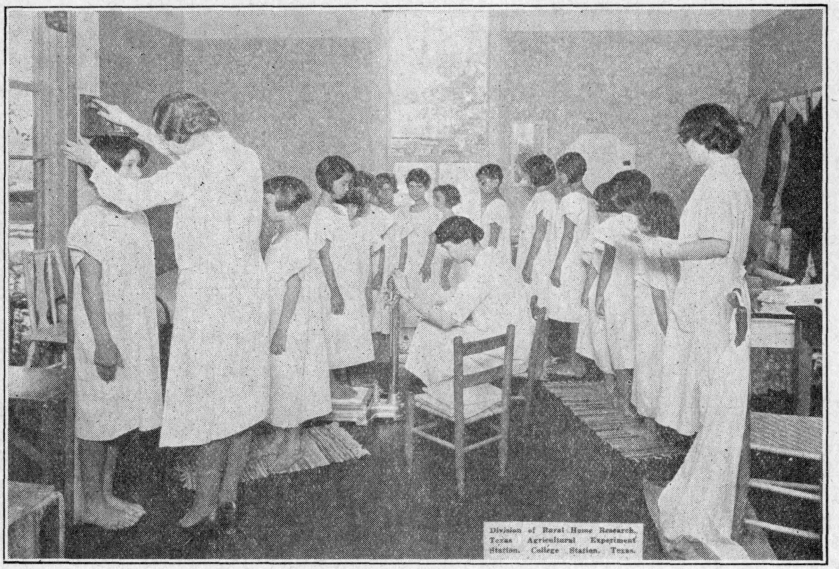

Fig. 1. Typical set-up for a measuring period in the weighing room at the Mexican school. The observer at the weighing scale recorded all measurements—weight, standing height, and sitting height. The assistant, at the right, brought the pupils from the class room, assisted them in donning the weighing garments, and organized the line of children. Weighing agrments, after use, were put into the laundry bag on the chair back at the right.

of data collection. Their accuracy was tested at intervals by the San Antonio sealer of weights and measures.

To make it possible to determine the nude body weight, weighing garments were worn during the weighing period. The younger boys and all the girls wore unbleached muslin robes made especially for the purpose, and the boys in the fourth grade and above wore regulation gymnasium suits of knitted shirts and cotton twill pants. These garments were laundered after each use and were checked at intervals for loss in weight. As each child was weighed, his weight was entered on his record card; the scale was read again and the record checked before the child stepped off the scale platform. The known weight of the weighing garment was subtracted from the weight of the child and the garment, to give the nude weight.

Standing and sitting heights were measured with the Baldwin measuring tape fastened with one-inch adhesive to a specially constructed board. This

board was fastened rigidly in a perpendicular position to the bench specially constructed for use in measuring sitting height. The technique of Baldwin (1) as modified by Roberts (20) was used for standing height. For sitting height (stem length), Roberts' (20) description of procedure was followed. A set of the equipment for measuring height was provided for each school. Metal calipers from the Smithsonian Institution were used for measuring width of shoulders and of hips, according to Baldwin's technique demonstrated to the author by a member of Dr. Baldwin's staff in the Iowa

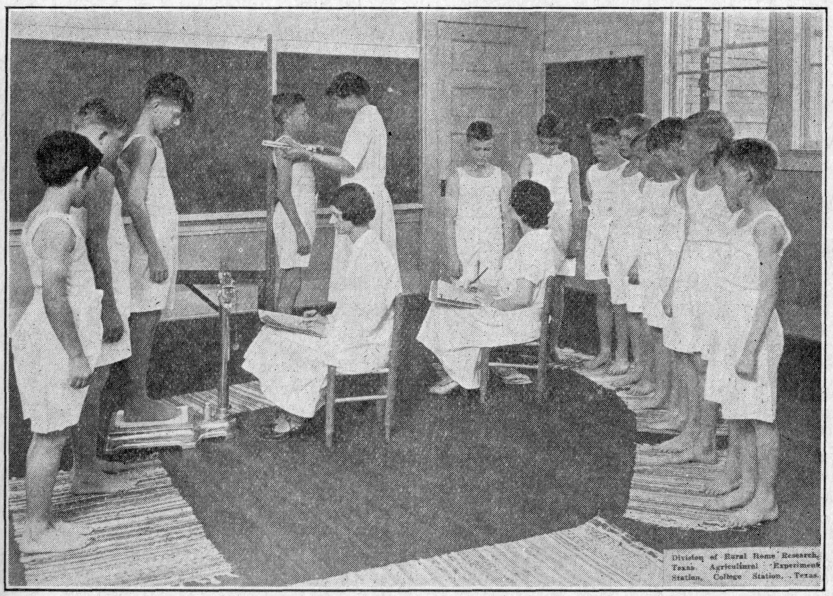

Fig. 2. Typical set-up for a measuring period in the white school. The observer at the weighing scale recorded all measurements—weight, width of shoulders, and width of hips. The assistant is questioning the pupils concerning their living conditions. Gymnasium suits were the weighing garments worn by boys in the third grade and above.

Child Welfare Research Station. Two observations each of standing and sitting heights and of width of hips and of shoulders were made upon each child. If these agreed, the result was recorded; if not, the measurement was repeated until satisfactory results were obtained.

With the exception of one period in the negro school when the weighing was done by the assistant, all measurements were made by the project leaders. Two observers worked together in those periods when more than one measurement was made, the observer who weighed the children doing all the recording. Between measuring periods the weighing scale and the equipment for measuring height were left in locked cases at the school.

The time of day for measuring any group of children was kept as nearly uniform throughout the two and one-half school years as was concordant

with the promotion of the children through the grades and the convenience of the teachers. Throughout each semester each class, the girls in one group, the boys in another, was brought to the weighing room in the same quarter of the school day. As the children went from their classroom to the weighing room, they were not permitted to drink at the fountain and they were sent to the toilet room to empty the urinary bladder. The extent to which the variable weight of the child's clothing, change in the time of day for weighing (afternoon to morning, or vice versa), and failure to empty the urinary bladder may effect the accuracy in determining monthly weight changes has been previously reported (22). These precautions are indispensable to accuracy.

Figures 1 and 2 show the weighing garments, the general lineup of a group of children in the weighing room, the equipment as it was set up for use, and selected steps in the technique of some of the measurements.

GROWTH IN WEIGHT

Selection of Records

The data upon weight have been examined from two approaches, (1) the performance of **groups** selected according to several different bases of classification within each race, and (2) the performance of a number of **individuals** in each race whose records were considered separately as well as in a group.

The number of children weighed each month varied, (1) because of changes in school population due to promotion out of the elementary grades and to entry of new pupils, (2) because of absences, and (3) because all weights were discarded that were less than the preceding in a given record when the loss in weight was associated with a major illness such as measles or influenza. If the child's weight was the same at two consecutive weighings or showed a gain despite his having suffered the illness, the weight was regarded as a valid one.

The results of preliminary analyses using the record of every child regardless of how often he was weighed, guided in selecting and handling data used for the present purpose. In a comparison of the mean weight of 42 each of morning-weighed and afternoon-weighed groups (10 white children, 16 Mexican, and 16 negro) selected by age to nearest birthday, only four were found in which there was a statistically significant difference, being respectively 4.48, 4.16, 4.04 and 4.30 times the probable error of the difference. Because of this preponderance of insignificant differences between mean weights of morning-weighed and afternoon-weighed groups, and because of other factors (such as variation in the weight of food eaten in the meals preceding the weighing, of liquids drunk, and of defecation) that had an influence, it was concluded to use morning and afternoon weights together in dealing with group values. The varying number of records in the several months was found unsuitable for the determination of seasonal variations. It became evident that the age of every child must be calculated from a fixed point in the calendar (January

Table 2. Number of children participating in this study.

Race	Sex	Total No.	Number used in this report									
			For weight gains								For height gains	
			Weighing record complete through one or both record years				With no loss recorded through one or both record years				Measured (in same ¼ of day) 5 times in 29 months	Measured (in same ¼ of day) 3 times in 12 months
			Group A	Group B	Group C	Total	Group X					
		Each child weighed from 1 to 21 times and height measured 1 to 5 times	1929 & 1930	1929 only	1930 only		1929 & 1930	1929 only	1930 only	Total	Group A	Group B
White	Boys	519	50	52	75		1	14	4		44	105
	Girls	462	34	43	70		1	6	14		28	71
		981	84	95	145	324	2	20	18	40	72	176
Mexican	Boys	421	33	59	41		0	9	5		15	53
	Girls	409	35	46	63		0	8	6		20	65
		830	68	105	104	277	0	17	11	28	35	118
Negro	Boys	362	49	37	58		0	11	3		70	141
	Girls	369	59	61	34		1	10	2		88	147
		731	108	98	92	298	1	21	5	27	158	288

1 was used) so as to hold each individual in a given age group through one 12-month cycle.

It was therefore decided to limit the records used to those in which the series of 9 weighings was unbroken through a period covering 12 consecutive calendar months. These were chosen to give the largest possible number of such records secured during the collection of data. The

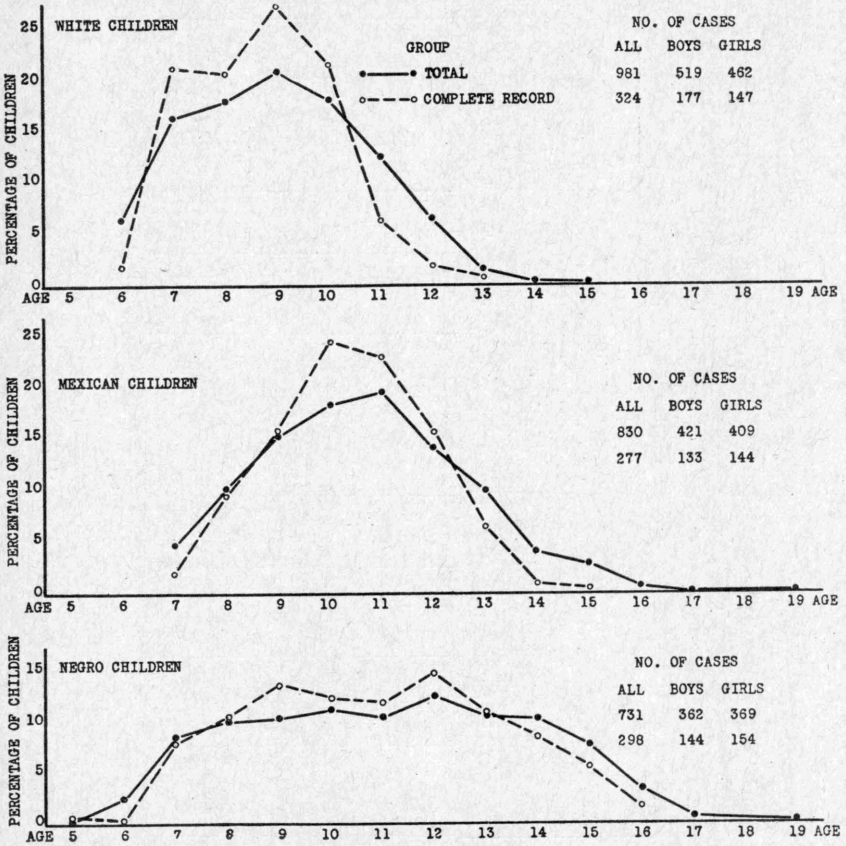

Fig. 3. Distribution of the total number of children weighed from 1 to 21 times within the period of data collection, and of the number who had "complete records" of weighing through one or both record years.

first such period extended from February 1929 through January 1930, and in this bulletin is called the "record year" of 1929; the "record year" of 1930 extended from February 1930 through January 1931. Each of these periods covered the growth made in 12 consecutive months. Children having this kind of a record are designated in this bulletin as "complete record" cases.

The complete records were classified according to the date of the record year in which the child was weighed. Three primary groups thus resulted.

Group A included the children who had records for both record years; group B had records for 1929 only; group C for 1930 only. As may be seen in Table 2 these three groups together constitute about one-third of the total number in each race on the weighing rolls. That the smaller

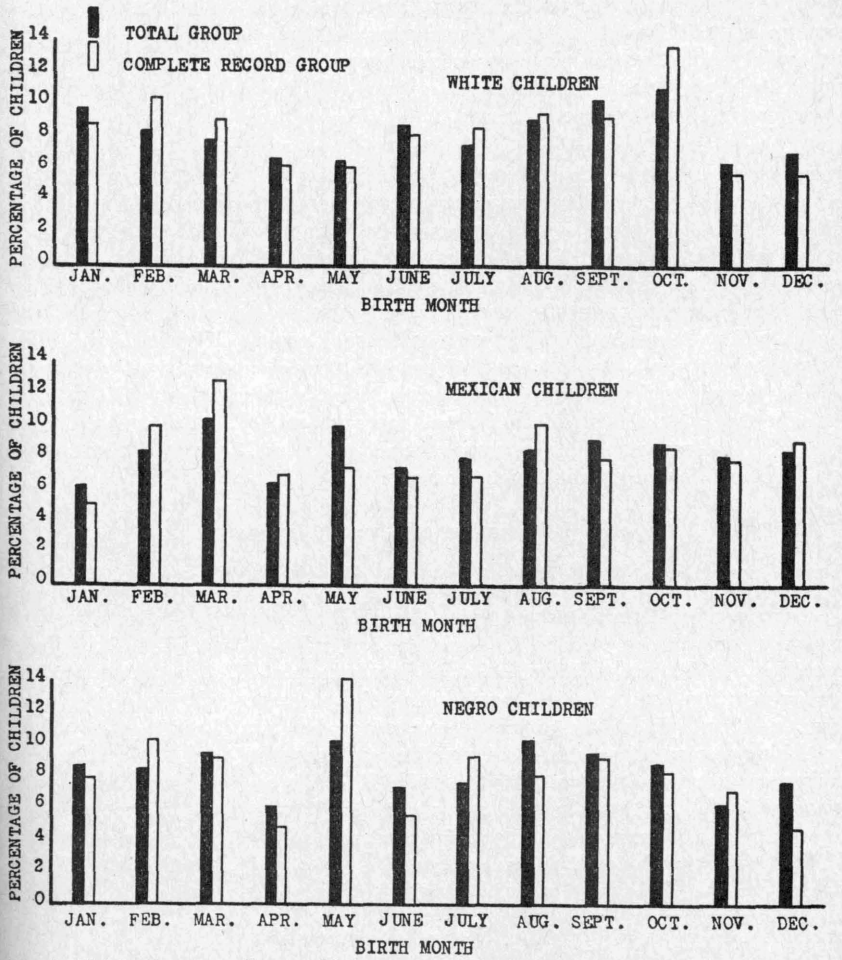

Fig. 4. Distribution according to birth-month of the total number of children weighed from 1 to 21 times within the period of data collection, and of the number who had "complete records" of weighing through one or both record years.

group of complete record cases is as satisfactory a sample as the corresponding larger group in each race, is indicated by the graphic presentation of data in Figures 3 and 4. The striking similarity is evident in the approximately equal representation of the sexes, and in the distribution of age groups and of birth months.

Of groups A, B, and C, only Group A, which included the same children in both record years, was analyzed separately. Group A was combined with Group B to give the largest possible number of "complete records" for 1929, and (for the same reason) with group C for 1930. The larger groups were desired for subclasses within each race. In all analyses with groups A, A+B, and A+C, the record years of 1929 and 1930 were treated separately so that the findings for seasonal aspects of growth in one year could serve as a check on the other. This was thought preferable to averaging the two record years.

A fourth smaller representation for each race, group X, was derived from the "complete record" cases. This group X (Table 2) constituted about 10 per cent of the "complete record" cases and included only those children whose every weight change, both monthly and summer, was either a gain, or zero. Selection of this group was based upon the consideration that having shown no loss at any weighing period, these children were probably the freest from factors disturbing growth and hence might more truly represent the normal course of growth for individuals than would be apparent from the trends shown by the groups which include children who lost weight occasionally. Group X is used chiefly for examination of individual records, but it is also treated as a group for comparison with groups A+B and A+C, which include both gainers and losers at each weighing period.

Seasonal Variation of Growth in Weight

Race Groups

Average Net Gains Derived from Group Weights. In all calculations of average weight per child the total group weight was divided by the number of children weighed. Gains (average per child, or total for the group during any selected period, month, summer, or year) were determined by subtracting either the average or total weight at a given weighing period from the corresponding (average or total) weight at the appropriate preceding weighing period. Monthly and seasonal gains as a percentage of the yearly gain were derived in the usual manner. Each monthly gain is recorded in the tables under the month which was the first of the two weighings between which the gain was made. Thus March weight minus February weight equals February gain, which is recorded under February.

An arbitrary division of the year into the three seasons which most naturally fit into the "record year" and the schedule of weighing followed in this study places February, March, and April in spring, May to September inclusive in summer, and October to January inclusive in fall-winter, hereafter referred to as fall. In the record year of 1929 the negroes were not weighed in May; hence their gain for the month of April 1929 cannot be calculated. The spring season for the negroes includes only 2 months, February and March; the summer includes 6 months, April through September.

The average gain per child for 12 months, during the consecutive weighing intervals of the year and the three seasons, has been determined for each race by the use of the smaller group and the larger group in each record year—group A, and group A+B in 1929; group A, and group A+C in 1930. The data are given in Table 3. The distribution of the monthly and summer gains as percentage of the yearly gain is shown graphically in Figure 5.

For each race, the data present a strikingly similar picture of growth in the two record years with both the smaller and larger groups. This, along with other considerations, is evidence that the percentage distribution of the yearly gain through each record year is acceptable despite some variation in length of the intervals. The weighing of the major portion of the children in group A was continued through March, April, and May of 1931. The average net gains per child in February for the white group was 0.99 pound in 1929, 0.42 pound in 1930, 0.96 pound in 1931; for Mexican, 0.92 pound in 1929, 0.67 pound in 1930, 1.02 pounds in 1931; and for negro, 0.70 pound in 1929, 0.49 pound in 1930, 1.28 pounds in 1931. The length of the February interval for white children in the three years in order was 35, 35, and 28 days. Yet their gain in February 1931 was nearer that of 1929 than that of 1929 and 1930 were to each other. The February intervals for Mexicans were 35, 33, and 35 days, and for negroes 34, 35, and 31 days in the three years; yet all three races showed lower gains in February of 1930 than in February of 1929 or 1931. The gain in the long October interval in 1929 for white children is matched by the gain of their shorter October interval in 1930. It is also approximately equalled by the gains of the Mexican children in October intervals which were shorter than for the white children each year. A smaller percentage of the yearly gain of white children was made in the short November interval of 1929 than in the longer November interval of 1930, but this was not true of Mexican and negro groups. With the exception of the A+C group of Mexicans, the November 1929 gains of Mexicans and negroes equalled or exceeded the gains of corresponding groups in 1930. Whatever effect the variation in the length of interval may have had appears to have been over-balanced by some other factors influencing weight gains in the several months.

Among the three race groups, similarity is much more conspicious than difference in distribution of gains through the divisions of the year. In all cases the four fall months, October through January, show more than one-third of the total gains for the year; and for all but group A of the negroes in 1930 the average monthly percentage gain in fall is greater than in either spring or summer for the same groups. The only noteworthy difference among the race groups is in the relative proportion of the gains made in summer and spring. The negro children gained relatively more than the white in summer and less in spring. The Mexicans held an intermediate position between the other two races. In 1930 the Mexican groups, like the negroes, show an average monthly percentage gain in summer only a little less than their average fall gain, with their

Table 3. Seasonal variation of growth in weight as shown by average monthly and seasonal gains in relation to yearly gain of children in each of 3 races

Group[1]	Record year	Race	No. of cases	Yearly gain	Average gain in pounds								Average gain as percentage of yearly gain											
					In single month			In summer	In single month				Monthly averages							By seasons			Seasonal averages		
													By months										Spring	Summer	Fall
					Feb.	Mar.	Apr.	May-Sept.[2]	Oct	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Oct.	Nov.	Dec.	Jan.	Spring	Summer	Fall	3[2] months Feb.-Apr.	5[2] months May-Sept.	4 months Oct.-Jan.
A	1929	White	84	7.23	0.99	0.36	0.46	2.51	1.07	0.32	0.70	0.82	13.7	5.0	6.4	14.8	4.4	9.7	11.3	8.3	6.9	10.1	25.0	34.7	40.3
		Mexican	68	8.10	0.92	0.61	0.11	3.02	1.14	0.90	0.82	0.58	11.4	7.5	1.4	14.1	11.1	10.1	7.2	6.7	7.5	10.6	20.3	37.3	42.5
		Negro	108	8.66	0.70	0.25	.....	4.24	1.16	0.63	0.83	0.85	8.1	2.9	.....	13.4	7.3	9.6	9.8	5.5	8.2	10.0	11.0[2]	49.0[2]	40.1
A	1930	White	84	7.58	0.42	0.91	0.21	2.60	1.14	0.78	1.05	0.47	5.5	12.0	2.8	15.0	10.3	13.9	6.2	6.8	6.9	11.3	20.3	34.3	45.4
		Mexican	68	9.36	0.67	0.48	0.57	4.02	1.20	0.65	1.06	0.71	7.2	5.1	6.1	12.8	6.9	11.3	7.6	6.1	8.6	9.7	18.4	43.0	38.7
		Negro	108	8.05	0.49	0.30	0.33	4.04	0.91	0.62	1.04	0.32	6.1	3.7	4.1	11.3	7.7	12.9	4.0	5.0	9.1	9.0	9.8[2]	54.3[2]	35.9
A+B	1929	White	179	7.71	1.13	0.44	0.44	2.56	1.08	0.42	0.64	1.00	14.7	5.7	5.7	14.0	5.5	8.3	13.0	8.7	6.6	10.2	26.1	33.2	40.7
		Mexican	173	8.39	1.06	0.62	0.14	3.08	1.16	0.83	0.78	0.72	12.6	7.4	1.7	13.8	9.9	9.3	8.6	7.2	7.3	10.4	21.7	36.7	41.6
		Negro	206	8.87	0.72	0.19	.....	4.62	1.01	0.70	0.80	0.83	8.1	2.1	.....	11.4	7.9	9.0	9.4	5.1	8.7	9.4	10.3[2]	52.1[2]	37.7
A+C	1930	White	229	7.32	0.50	0.81	0.21	2.41	1.18	0.78	0.53	0.90	6.8	11.1	2.9	16.1	10.7	7.2	12.3	6.9	6.6	11.5	20.8	32.9	46.3
		Mexican	172	8.05	0.61	0.50	0.42	3.38	1.16	0.53	1.05	0.40	7.6	6.2	5.2	14.4	6.6	13.0	5.0	6.3	8.5	9.8	19.0	42.0	39.0
		Negro	200	8.23	0.48	0.24	0.39	3.97	0.95	0.67	1.10	0.43	5.8	2.9	4.7	11.5	8.1	13.4	5.2	4.4	8.8	9.5	8.8[2]	53.0[2]	38.3

[1]A, includes all children who were weighed throughout both record years—1929 and 1930.
B, includes all children who were weighed throughout record year of 1929 only.
C, includes all children who were weighed throughout record year of 1930 only.
Therefore A+B includes all children who had an unbroken weighing record for 1929.
A+C includes all children who had an unbroken record for 1930.
[2]Summer 1929 for negro, April-September; spring, February and March.

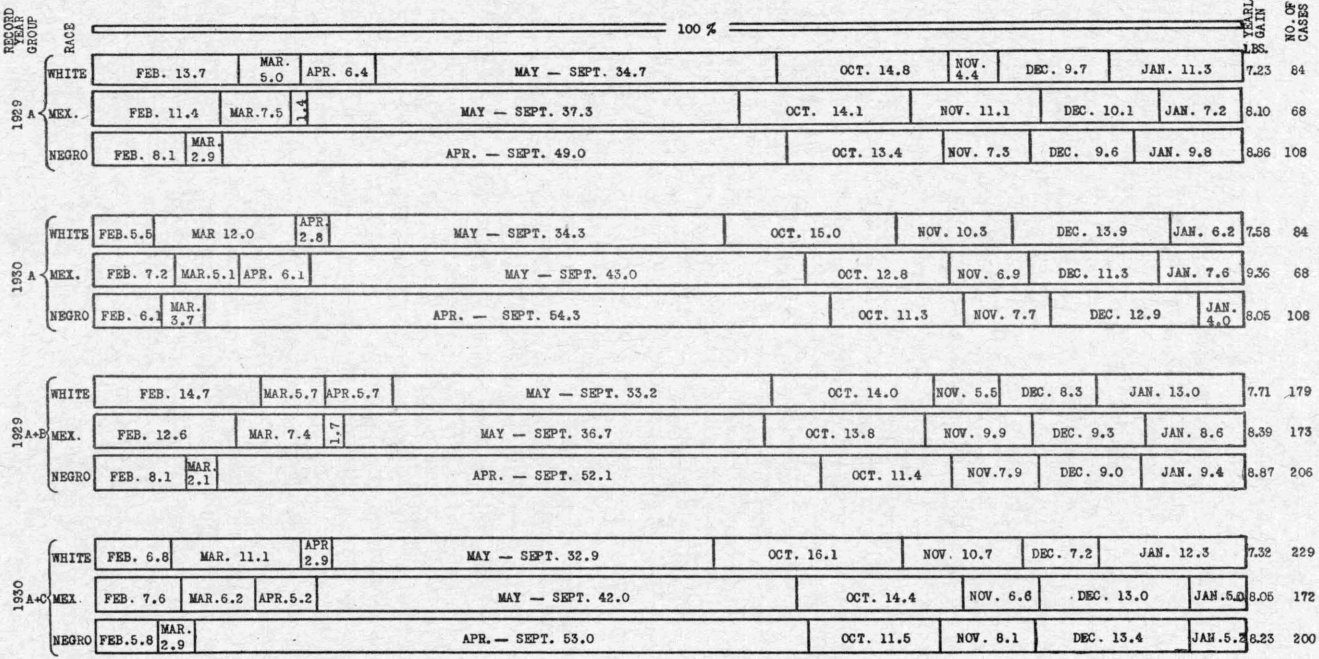

Fig. 5. Distribution of monthly and summer gains as percentage of the yearly gain made by the smaller and the larger group of each race in each record year.

lowest rate of gain in spring; in the 1929 group, however, the Mexicans resemble the white children in that the spring and summer rates in the same group were practically the same, or differed little.

Only two outstanding features of gains made in single months appear. October was consistently a good gaining month, and April was consistently a poor gaining month. October gains range in the twelve groups from 11.3 per cent to 16.1 per cent of the yearly gain, and April gains from 1.4 per cent to 6.4 per cent among the ten groups for which April gain could be determined. Among the groups of white children, approximately one-half as much gain was made in the single month of October as in the preceding five summer months; among the Mexican groups, one-third as much; and in two of the four negro groups, one-fourth as much as in the preceding five months and six months respectively. No generalization can be made concerning the proportion of the yearly growth in any other single month that will always hold for the three races. March was usually but not always a poor gaining month, six of ten groups showing no better gains for March than April; two groups (A, and A+C) for white children showing excellent gains (11 per cent and 12 per cent of the yearly gain); and two groups (A, and A+B) for the Mexican showing moderate gains (7.4 per cent and 7.5 per cent of the yearly total). The first fall weighing of 1930 for all Mexican and negro children in group A and for all but one Mexican and six negro children in the A+C group was made in September. Group A of Mexicans gained in September 1.08 pounds, in October 1.23 pounds; group A+C gained in September 0.93 pound, in October 1.15 pounds. Group A of negroes gained in September 1.02 pounds, in October 0.92 pound; group A+C gained in September 0.86 pound, in October 0.95 pound. From these data September of 1930 is seen to have been practically as good a gaining month as October for the negro and Mexican children.

The race differences found in seasonal variation of growth in weight are so small that they can scarcely be attributed to inherent racial characteristics, without elimination of other factors that may influence growth, and such elimination cannot be made from the data of this study. The variation found between the three races and within the Mexican race, in relative proportion of the yearly gain made in spring and summer, suggests that some other factor was exerting an effect upon rate of gaining, along with any biological phenomenon which tends to express itself in a rythmic seasonal variation in growth.

The exceptionally good gains in October and conspicuously lower gains in April are in harmony with the findings of the recent study of the U. S. Public Health Service with white children in Hagerstown, Maryland, reported by Palmer (17), and also with those of Turner (24) for fourth to seventh grade pupils in the schools of Boston. The Texas children, however, do not exhibit the gradual reduction in rate of growth through the subsequent fall and winter months that Palmer notes for the Maryland children. That April and other spring months need not be a poor gaining time has been demonstrated recently by Thompson and Scholtz

(23) with 24 Jewish girls 6 to 16 years of age, in Southern California. These girls were placed under a closely supervised health routine which curtailed exercise, provided for more than the usual number of hours in bed each day, and maintained a generous well-selected diet. From January 25 to May 10, 17 of these 24 girls equaled or exceeded their expected gain in weight for the entire year. Some of them made gains from twice to several times as great as the expected yearly gain, and certainly more than reasonably could be attributed to the accelerated rate characteristic of an under-nourished individual. What influences among these Texas children may have been responsible for the exceptional gains in October and the conspicuous lack of gains in April is a question of considerable interest calling for further study.

Individual Monthly Weight Changes. A further comparison of the gains made by each race in the single months of each record year is based on the monthly weight changes of each individual in the several groups. To effect the greatest possible accuracy within the limits of these data, the monthly changes in weight were calculated for only those children who were weighed in the same quarter of the school day at each two consecutive weighing dates under consideration. Since the larger and smaller groups in each race gave essentially the same picture of growth, only the two groups containing the largest numbers were used for this analysis (A+B for 1929 and A+C for 1930). The manner in which the gainers and losers contributed to the average net gain may be judged from the data in Tables 4 and 5. Table 4 presents a summary of the individual weight changes for the 7 months in each record year; Table 5 shows the detailed data for each of the 7 months.

From the summary of all monthly changes made by each race (Table 4) the predominance of similarities over differences in the three races is evident; but at the same time one point of variance of the negroes from the other two races is plain. The ratio of number of gainers to number of losers is 2.99 to 1 among Mexican children, 2.94 to 1 among white children, and 2.23 to 1 among negro children. The average monthly gain per child derived from the net gain of the entire group is practically the same for white and Mexican children (0.72 and 0.71 pound, respectively, for the two record years together), but is slightly lower for the negro (0.61 pound). In contrast, the average monthly gain per child based upon the average actual increments in the gaining group of each race is a trifle greater for the negro than for the other two races, as would be expected from the greater proportion of children 13 years or over among the negroes, as is noted later. The average monthly loss per child calculated from the actual total losses were respectively for the two record years, white children 0.61 and 0.55 pound; Mexican 0.61 and 0.62 pound; negro 0.78 and 0.70 pound.

The distribution of actual individual monthly gains and losses is closely similar in the two record years for each race, and is also similar for the three races in each record year. About 1/5 of the children had monthly gains less than ½ pound; about ¼ of them gained from 8 to 15 ounces;

Table 4. Summary of monthly changes in weight for 7 months in each record year

Race	Record year	Total group		Individual monthly weight changes						Distribution of monthly changes in weight made in Feb., Mar., Apr., Oct., Nov., Dec., Jan., of each year																	
				Cases having weight change[1]				Av. gain of gainers	Av. loss of losers	Gainers										Losers							
		No. of cases	Av. net gain per child, Lbs.	Total No.	No. gainers	No. losers	Ratio: No. gainers to No. losers	Lbs.	Lbs.	1-7 oz.		8-15 oz.		1 lb.-1lb.7oz.		1lb.8oz.-1lb15oz.		2 lbs. & +		0-7 oz.		8-15 oz.		1 lb-1lb. 7oz.		1lb.8oz.-1lb.15oz.		2 lbs. & +	
										No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
White	1929	1253	0.74	1231	930	301	3.1:1	1.21	0.61	223	24.0	236	25.4	186	20.0	125	13.4	160	17.2	169	56.2	73	24.3	35	11.6	15	5.0	9	3.0
	1930	1603	0.70	1528	1129	399	2.8:1	1.17	0.55	229	20.3	302	26.8	263	23.3	170	15.1	165	14.6	214	53.6	115	28.8	38	9.5	20	5.0	12	3.0
	Total	2856	0.72	2759	2059	700	2.94:1	1.19	0.58	452	22.0	538	26.1	449	21.8	295	14.3	325	15.8	383	54.7	188	26.9	73	10.4	35	5.0	21	3.0
Mexican	1929	1211	0.76	1140	854	286	3.0:1	1.24	0.61	161	18.9	225	26.4	178	20.8	134	15.7	156	18.3	147	51.4	82	28.7	35	12.2	12	4.2	10	3.5
	1930	1204	0.67	1152	863	289	3.0:1	1.17	0.62	185	21.4	231	26.8	182	21.1	143	16.6	122	14.1	140	48.4	86	29.8	37	12.8	19	6.6	7	2.4
	Total	2415	0.71	2292	1717	575	2.99:1	1.20	0.62	346	20.2	456	26.6	360	21.0	277	16.1	278	16.2	287	49.9	168	29.2	72	12.5	31	5.4	17	3.0
Negro	1929	1442	0.61	1217	860	357	2.4:1	1.33	0.78	167	19.4	219	25.5	156	18.1	110	12.8	208	24.2	156	43.7	101	28.3	45	12.6	27	7.6	28	7.8
	1930	1400	0.61	1387	937	450	2.1:1	1.25	0.70	222	23.7	240	25.6	172	18.4	117	12.5	186	19.9	219	48.7	123	27.3	50	11.1	24	5.3	34	7.6
	Total	2842	0.61	2604	1797	807	2.23:1	1.29	0.73	389	21.7	459	25.5	328	18.3	227	12.6	394	21.9	375	46.5	224	27.8	95	11.8	51	6.3	62	7.7

[1]Weight changes were calculated for only those individuals who were weighed in the same quarter of the day in each two consecutive weighing dates under consideration.

about 1/5 gained 1 pound to 1 pound 7 ounces; the remainder gained higher amounts. Losses of less than ½ pound were shown by nearly ½ of each race; almost 1/3 of each race lost between 8 ounces and 1 pound; the remainder lost higher amounts.

The data in Table 5 depict the growth of the three races by months in each record year. It is evident that while the negroes have less variation than do either of the Mexican groups or either of the white groups in the ratio of number of gainers to number of losers, the four fall months together show in every instance a higher ratio of gainers to losers than do the three spring months. With but one exception (March 1930 for negroes), April has the lowest ratio of gainers to losers, the range for the three races being from 1.1 (white group 1929) to 1.9 (white group 1930). October has the highest ratio of gainers to losers among all the months except February 1929 for white and for Mexican children. The range of ratios of gainers to losers in October is from 3.0 (negro 1929) to 8.4 (Mexican 1930). There is a tendency, which is regular only in the Mexican and negro groups in 1929, for the ratios to become gradually smaller from February through April, and again from October through January, with February the best spring month and October the best fall month for numbers of children to gain weight. March 1930 for white children and November 1929 for negro, show high ratios of gainers.

With respect to the magnitude of the average monthly individual gains, however, no such gradation is evident. In fact, the average individual monthly gains per child show that October, while always an excellent gaining month, is fairly comparable with two or three other months in the same record year rather than an exceptionally good month for gains as indicated by the average gain per child based on the net gains of the total group. Nor are the average individual losses lowest in October of a given record year except for the white children. Most of the average individual monthly gains including those of April were near 1 to 1.25 pounds; the range for the three races is from 0.75 pound to 1.66 pounds.

In a comparison of the percentage distribution of actual individual monthly gains in the separate months with the average of the 7 months in each record year, April shows consistently somewhat higher percentages than the average in the interval of 1 to 7 ounces, and somewhat lower percentages in the intervals from 1 pound 8 ounces to 2 pounds and over; October exactly reverses this relationship, showing a lower percentage of children who gained less than ½ pound and a higher percentage of children who added more than 1½ pounds to their weight. In this respect, March resembles April among Mexican and negro children; January resembles October in both years for the Mexican and the 1929 negro groups; and November resembles October in the 1930 negro group. The distribution of the actual losses in separate months shows, on the whole, less variation from the average of the 7 months than is true of the distribution of gains.

Table 5. Changes in weight by months in each record year

Race	Record year	Month of wt. change	Total group: No. of cases	Total group: Av. gain per child (Lbs.)	Individual monthly weight changes: Cases having weight change[1]: Total No.	No. gainers	No. losers	Ratio: no. of gainers to no. of losers: Month	Spring	Fall	Av. gain of gainers (Lbs.)	Av. loss of losers (Lbs.)	Distribution of monthly weight changes: Gainers: 1-7 oz. No.	%	8-15oz. No.	%	1 lb.-1lb.7oz. No.	%	1lb.8oz.-1lb.15oz. No.	%	2 lbs. & + No.	%	Losers: 0-7 oz. No.	%	8-15 oz. No.	%	1 lb.-1lb.7oz. No.	%	1lb.8oz.-1lb.15oz. No.	%	2 lbs. & + No.	%
White children	1929	Feb.	179	1.13	166	148	18	8.2:1			1.39	0.60	26	17.6	32	21.6	35	23.7	17	11.5	38	25.7	9	50.0	6	33.3	1	5.6	1	5.6	1	5.6
		Mar.	179	0.44	179	121	58	2.1:1			1.10	0.62	27	22.3	39	32.2	29	24.0	18	14.9	8	6.6	36	62.1	11	19.0	7	12.1	3	5.2	1	1.7
		Apr.	179	0.44	174	115	59	1.9:1			1.09	0.59	39	33.9	35	30.4	20	17.4	8	7.0	13	11.3	36	61.0	13	22.0	5	8.5	3	5.1	2	3.4
		Oct.	179	1.08	179	152	27	5.6:1			1.35	0.45	27	17.8	34	22.4	28	18.4	29	19.1	34	22.4	16	59.3	6	22.2	5	18.5	0		0	
		Nov.	179	0.42	179	118	61	1.9:1			0.98	0.66	36	30.5	34	28.8	23	19.5	10	8.5	15	12.7	32	52.5	16	26.2	8	13.1	2	3.3	3	4.9
		Dec.	179	0.64	179	133	46	2.9:1			1.10	0.70	36	27.1	34	25.6	23	17.3	20	15.0	20	15.0	24	52.2	10	21.7	5	10.9	5	10.9	2	4.4
		Jan.	179	1.00	175	143	32	4.5:1			1.33	0.56	32	22.4	28	19.6	28	19.6	23	16.1	32	22.4	16	50.0	11	34.4	4	12.5	1	3.1	0	
		Total	1253		1231	930	301						223	24.0	236	25.4	186	20.0	125	13.4	160	17.2	169	56.2	73	24.3	35	11.6	15	5.0	9	3.0
		Av.	179	0.74				3.1:1	2.8:1	3.3:1	1.21	0.61																				
	1930	Feb.	229	0.50	228	157	71	2.2:1			0.93	0.48	44	28.0	52	33.1	33	21.0	15	9.6	13	8.3	41	57.8	20	28.2	8	11.3	0		2	2.8
		Mar.	229	0.81	229	186	43	4.3:1			1.11	0.50	43	23.1	46	24.7	43	23.1	37	19.9	17	9.1	19	44.2	18	41.9	3	7.0	0		3	7.0
		Apr.	229	0.21	163	86	77	1.1:1			0.98	0.65	24	27.9	25	29.1	22	25.6	8	9.3	7	8.1	40	52.0	20	26.0	8	10.4	7	9.1	2	2.6
		Oct.	229	1.18	227	196	31	6.3:1			1.43	0.42	27	13.8	45	23.0	41	20.9	37	18.9	46	23.5	19	61.3	8	25.8	3	9.7	1	3.2	0	
		Nov.	229	0.78	228	179	49	3.7:1			1.13	0.51	38	21.2	43	24.0	48	26.8	26	14.5	24	13.4	29	59.2	9	18.4	8	16.3	2	4.1	1	2.0
		Dec.	229	0.53	228	176	52	3.4:1			1.29	0.66	29	16.5	44	25.0	42	23.9	27	15.3	34	19.3	25	48.1	18	34.6	3	5.8	4	7.7	2	3.9
		Jan.	229	0.90	225	149	76	2.0:1			1.20	0.58	24	16.1	47	31.5	34	22.8	20	13.4	24	16.1	41	54.0	22	29.0	5	6.6	6	7.9	2	2.6
		Total	1603		1528	1129	399						229	20.3	302	26.8	263	23.3	170	15.1	165	14.6	214	53.6	115	28.8	38	9.5	20	5.0	12	3.0
		Av.	229	0.70				2.8:1	2.2:1	3.4:1	1.17	0.55																				
Mexican children	1929	Feb.	173	1.06	170	143	27	5.3:1			1.39	0.65	20	14.0	35	24.5	33	23.1	20	14.0	35	24.5	12	44.4	11	40.7	3	11.1	0		1	3.7
		Mar.	173	0.62	171	127	44	2.9:1			1.06	0.50	36	28.4	29	22.8	27	21.3	19	15.0	16	12.6	26	59.1	11	25.0	5	11.4	2	4.5	0	
		Apr.	173	0.14	165	89	76	1.2:1			0.75	0.65	31	34.8	31	34.8	18	20.2	3	3.4	6	6.7	36	47.4	22	29.0	11	14.5	4	5.3	3	4.0
		Oct.	173	1.16	173	145	28	5.2:1			1.51	0.58	15	10.3	38	26.2	29	20.0	25	17.2	38	26.2	16	57.1	7	25.0	4	14.3	0		1	3.6
		Nov.	173	0.83	173	138	35	4.9:1			1.14	0.46	21	15.2	45	32.6	31	22.5	21	15.2	20	14.5	23	65.7	9	25.7	1	2.9	2	5.7	0	
		Dec.	173	0.78	171	126	45	3.8:1			1.26	0.63	26	20.6	27	21.4	28	22.2	25	19.8	20	15.9	22	48.9	14	31.1	4	8.9	3	6.7	2	4.6
		Jan.	173	0.72	117	86	31	2.8:1			1.40	0.81	12	14.0	20	23.3	12	14.0	21	24.4	21	24.4	12	38.7	8	25.8	7	22.6	1	3.2	3	9.7
		Total	1211		1140	854	286						161	18.9	225	26.4	178	20.8	134	15.7	156	18.3	147	51.4	82	28.7	35	12.2	12	4.2	10	3.5
		Av.	173	0.76				3.0:1	2.4:1	3.6:1	1.24	0.61																				

[1]Weight changes were calculated for only those individuals who were weighed in the same quarter of the day in each two consecutive weighing dates

Race	Record year	Month of wt. change	Total group: No. of cases	Total group: Av. gain per child, Lbs.	Individual monthly weight changes: Cases having weight change[1]: Total No.	No. gainers	No. losers	Ratio: No. of gainers to No. of losers: Month	Spring	Fall	Av. gain of gainers, Lbs.	Av. loss of losers, Lbs.	Distribution of monthly weight changes: Gainers: 1-7 oz. No.	%	8-15oz. No.	%	1 lb.-1lb.7oz. No.	%	1lb.8oz.-1lb.15oz. No.	%	2 lbs. & + No.	%	Losers: 0-7 oz. No.	%	8-15 oz. No.	%	1 lb.-1lb.7oz. No.	%	1lb.8oz.-1lb.15oz. No.	%	2 lbs. & + No.	%
Mexican children—Cont.	1930	Feb.	172	0.61	170	122	48	2.5 :1			1.02	0.58	31	25.4	35	28.7	21	17.2	18	14.8	17	13.9	22	45.8	17	35.4	4	8.3	5	10.4	0	
		Mar.	172	0.50	171	118	53	2.2 :1			1.03	0.71	32	27.1	31	26.3	28	23.7	16	13.6	11	9.3	25	47.2	14	26.4	8	15.1	3	5.7	3	5.7
		Apr.	172	0.42	165	105	60	1.8 :1			1.05	0.64	30	28.6	28	26.7	20	19.1	15	14.3	12	11.4	24	40.0	22	36.7	9	15.0	4	6.7	1	1.7
		Oct.	172	1.16	170	152	18	8.4 :1			1.41	0.75	20	13.2	41	27.0	29	19.1	32	21.1	30	19.7	6	33.3	5	27.8	6	33.3	1	5.6	0	
		Nov.	172	0.53	172	139	33	4.2 :1			1.01	0.38	33	23.7	45	32.4	29	20.9	22	15.8	10	7.2	25	75.8	6	18.2	0		2	6.1	0	
		Dec.	172	1.05	171	126	45	2.8 :1			1.35	0.61	22	17.5	32	25.4	29	23.0	19	15.1	24	19.1	24	53.3	11	24.4	6	13.3	3	6.7	1	2.2
		Jan.	172	0.40	133	101	32	3.2 :1			1.29	0.71	17	16.8	19	18.8	26	25.7	21	20.8	18	17.8	14	43.8	11	34.4	4	12.5	1	3.1	2	6.3
		Total	1204		1152	863	289						185	21.4	231	26.8	182	21.1	143	16.6	122	14.1	140	48.4	86	29.8	37	12.8	19	6.6	7	2.4
		Av.	172	0.67				3.0 :1	2.1 :1	4.1 :1	1.17	0.62																				
Negro children	1929	Feb.	206	0.72	204	150	54	2.8 :1			1.21	0.65	24	16.0	49	32.7	36	24.0	17	11.3	24	16.0	24	44.4	18	33.3	5	9.3	6	11.1	1	1.9
		Mar.	206	0.19	204	119	85	1.4 :1			0.89	0.80	46	38.7	32	26.9	18	15.1	12	10.1	11	9.2	34	40.0	21	24.7	17	20.0	7	8.2	6	7.1
		Apr.	-----	----	-----	-----	---	-----			----	----	---	----	---	----	---	----	---	----	---	----	---	----	---	----	---	----	---	----	---	----	---	----
		Oct.	206	1.01	206	154	52	3.0 :1			1.57	0.63	23	14.9	31	20.1	29	18.8	15	9.7	56	36.4	30	57.7	11	21.2	4	7.7	5	9.6	2	3.9
		Nov.	206	0.70	206	153	53	2.9 :1			1.23	0.77	28	18.3	45	29.4	32	20.9	17	11.1	31	20.3	25	47.2	12	22.6	9	17.0	2	37.7	5	9.4
		Dec.	206	0.80	206	149	57	2.6 :1			1.50	0.98	29	19.5	32	21.5	20	13.4	20	13.4	48	32.2	19	33.3	22	38.6	4	7.0	3	5.3	9	15.8
		Jan.	206	0.83	191	135	56	2.4 :1			1.52	0.79	17	12.6	30	22.2	21	15.6	29	21.5	38	28.2	24	42.9	17	30.4	6	10.7	4	7.1	5	8.9
		Total	1442		1217	860	357						167	19.4	219	25.5	156	18.1	110	12.8	208	24.2	156	43.7	101	28.3	45	12.6	27	7.6	28	7.8
		Av.	206	0.61				2.4 :1	1.9 :1	2.7 :1	1.33	0.78																				
	1930	Feb.	200	0.48	200	141	59	2.4 :1			0.93	0.57	42	29.8	46	32.6	29	20.6	12	8.5	12	8.5	37	62.7	14	23.7	2	3.4	2	3.4	4	6.8
		Mar.	200	0.24	199	109	90	1.2 :1			1.03	0.69	36	33.0	28	25.7	17	15.6	11	10.1	17	15.6	41	45.6	28	31.1	11	12.2	2	2.2	8	8.9
		Apr.	200	0.39	199	126	73	1.7 :1			1.03	0.70	34	27.0	37	29.4	28	22.2	9	7.1	18	14.3	32	43.8	23	31.5	8	11.0	7	9.6	3	4.1
		Oct.	200	0.95	200	159	41	3.9 :1			1.35	0.59	30	18.9	37	23.3	31	19.5	26	16.4	35	22.0	25	61.0	7	17.1	3	7.3	3	7.3	3	7.3
		Nov.	200	0.67	200	139	61	2.3 :1			1.29	0.75	22	15.8	44	31.7	26	18.7	25	18.0	22	15.8	28	45.9	18	29.5	8	13.1	2	3.3	5	8.2
		Dec.	200	1.10	198	151	47	3.2 :1			1.66	0.69	30	19.9	26	17.2	22	14.6	18	11.9	55	36.4	22	46.8	14	29.8	6	12.8	2	4.3	3	6.4
		Jan.	200	0.43	191	112	79	1.4 :1			1.37	0.83	28	25.0	22	19.6	19	17.0	16	14.3	27	24.1	34	43.0	19	24.1	12	15.2	6	7.6	8	10.1
		Total	1400		1387	937	450						222	23.7	240	25.6	172	18.4	117	12.5	186	19.9	219	48.7	123	27.3	50	11.1	24	5.3	34	7.6
		Av.	200	0.61				2.1 :1	1.7 :1	2.5 :1	1.25	0.70																				

[1]Weight changes were calculated for only those individuals who were weigh ed in the same quarter of the day in each two consecutive weighing dates under consideration.

The individual monthly weight changes provide a picture of growth during the 7 months in each record year that is essentially the same for all three races. The chief racial difference is in the ratio of the number of gainers to the number of losers, an average of approximately 3 times as many white and Mexican children having gained each month as lost, while only 2 times as many negroes gained as lost. Some factor (or factors) somewhat more favorable to growth in fall months than spring months was apparently operative. The effect found expression more in the greater proportion of children who gained in fall than in spring, than in the average amount of weight gained by the gaining group, or lost by the losing group. April and October are conspicuous, the former for poorer gains, the latter for better, but they are less outstanding among the single months when individual changes in weight are considered than when net gains of the entire group are used to determine average monthly gain per child.

Sex Groups

The comparative average net gains derived from group weights of the two sexes in each race are shown by the data in Table 6. The yearly gain of the white girls exceeded that of the white boys' by from 1 to 3 pounds, Mexican girls that of the Mexican boys by from 1½ to 3 pounds, while the negro boys and girls differed by from ½ to 2 pounds, the boys having the advantage in the two larger groups which included a few more boys of 13 years or over. This sex difference in favor of the Mexican and white girls and the negro girls in 2 of 4 groups was due, no doubt, to the influence of gains of the adolescent girls who experience this acceleration of growth at an earlier age than do boys. A larger proportion of the negro children was 13 years of age or over than was the case in the other two races and hence included more adolescent boys.

The distribution of the average gain per child as percentage of the yearly gain through the single months and the summer period present, in each record year, strikingly similar pictures for the two sexes, especially in the case of the white children. In all twelve groups, October as a single month is outstanding with large, close, and oftentimes nearly identical percentages of the yearly gain for boys and girls. April is conspicuous for the low percentage of the yearly gain, being never as much as 1/12 of the yearly gain, and once even showing a loss. April also exhibits the most frequent sex differences. Three of the four groups of the white girls and two of the four groups of the Mexican girls made slightly greater gains in April than did the boys in the corresponding groups, but the gains of negro boys in April exceeded those of the girls. If for the white children April gain is added to the summer gain in each group, the resulting six months period shows the same percentage of the yearly growth for boys and girls in three groups, and in the fourth, the girls have only 5 per cent more of their gain in the summer than do the boys. The only other single months showing sex differences worthy of mention are adjacent spring months (February and March) in two of the

Table 6. Seasonal variation of growth in weight of boys and girls in each race as shown by average monthly and summer gains in relation to yearly gain

Race	Group[1]	Record year	Sex	No. cases	Yearly gain	Average gain in pounds								Average gain as a percentage of yearly gain							
						In single month			In summer[2]	In single month				In single month			In summer[2]	In single month			
						Feb.	Mar.	Apr.	May-Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May-Sept.	Oct.	Nov.	Dec.	Jan.
White	A	1929	Boys	50	6.83	0.95	0.37	0.37	2.29	1.07	0.33	0.55	0.90	13.9	5.4	5.4	33.5	15.7	4.8	8.1	13.2
			Girls	34	7.84	1.06	0.33	0.62	2.82	1.08	0.31	0.91	0.71	13.5	4.2	7.9	36.0	13.8	4.0	11.6	9.1
	A	1930	Boys	50	6.45	0.33	0.83	-0.07	2.46	0.90	0.69	0.88	0.43	5.1	12.9	-1.1	38.1	14.0	10.7	13.6	6.7
			Girls	34	9.23	0.54	1.04	0.62	2.79	1.50	0.93	1.28	0.53	5.9	11.3	6.7	30.2	16.3	10.1	13.9	5.7
	A+B	1929	Boys	102	7.29	1.09	0.43	0.42	2.38	1.05	0.37	0.56	0.99	15.0	5.9	5.8	32.7	14.4	5.1	7.7	13.6
			Girls	77	8.27	1.18	0.45	0.46	2.80	1.12	0.49	0.74	1.03	14.3	5.4	5.6	33.9	13.5	5.9	9.0	12.5
	A+C	1930	Boys	125	6.84	0.42	0.83	0.05	2.47	0.98	0.72	0.84	0.53	6.1	12.1	0.7	36.1	14.3	10.5	12.3	7.8
			Girls	104	7.88	0.59	0.78	0.41	2.34	1.41	0.85	0.16	1.34	7.5	9.9	5.2	29.7	17.9	10.8	2.0	17.0
Mexican	A	1929	Boys	33	6.72	0.69	0.53	0.12	2.14	0.96	1.02	1.11	0.15	10.3	7.9	1.8	31.8	14.3	15.2	16.5	2.2
			Girls	35	9.41	1.13	0.70	0.10	3.84	1.32	0.78	0.55	0.91	12.0	7.4	1.1	40.8	14.0	8.3	5.9	10.5
	A	1930	Boys	33	7.61	0.33	0.67	0.25	3.10	1.11	0.46	1.32	0.37	4.3	8.8	3.3	40.7	14.6	6.1	17.4	4.9
			Girls	35	11.01	0.98	0.32	0.86	4.88	1.28	0.85	0.80	1.04	8.9	2.9	7.8	44.3	11.6	7.7	7.3	9.5
	A+B	1929	Boys	92	7.69	0.97	0.63	0.11	2.55	1.02	0.90	0.90	0.61	12.6	8.2	1.4	33.2	13.3	11.7	11.7	7.9
			Girls	81	9.18	1.15	0.62	0.18	3.66	1.34	0.75	0.62	0.86	12.5	6.8	2.0	39.9	14.6	8.2	6.8	9.4
	A+C	1930	Boys	74	7.19	0.35	0.65	0.21	2.49	1.02	0.63	1.14	0.70	4.9	9.0	2.9	34.6	14.2	8.8	15.9	9.7
			Girls	98	8.68	0.80	0.38	0.60	4.03	1.26	0.46	0.98	0.17	9.2	4.4	6.9	46.4	14.5	5.3	11.3	2.0
Negro	A	1929	Boys	49	8.12	0.63	0.22	.. ....	4.07	1.01	0.47	0.80	0.92	7.8	2.7	....	50.1	12.4	5.8	9.9	11.3
			Girls	59	9.12	0.77	0.27	.. ....	4.38	1.28	0.76	0.87	0.79	8.4	3.0	....	48.0	14.0	8.3	9.5	8.7
	A	1930	Boys	49	8.37	0.63	0.18	0.54	4.12	0.82	0.61	1.31	0.16	7.5	2.2	6.5	49.2	9.8	7.3	15.7	1.9
			Girls	59	8.63	0.38	0.40	0.15	3.97	0.99	0.62	0.82	1.30	4.4	4.6	1.7	46.0	11.5	7.2	9.5	15.1
	A+B	1929	Boys	86	9.18	0.78	0.24	.. ....	4.99	1.00	0.64	0.57	0.96	8.5	2.6	....	54.4	10.9	7.0	6.2	10.5
			Girls	120	8.66	0.69	0.14	.. ....	4.35	1.03	0.74	0.97	0.74	8.0	1.6	—	50.2	11.9	8.6	11.2	8.6
	A+C	1930	Boys	107	9.10	0.56	0.23	0.54	4.32	0.94	0.75	1.33	0.43	6.2	2.5	5.9	47.5	10.3	8.2	14.6	4.7
			Girls	93	7.24	0.39	0.27	0.22	3.55	0.96	0.58	0.84	0.43	5.4	3.7	3.0	49.0	13.3	8.0	11.6	5.9

[1]See footnote Table 3.
[2]Summer 1929 for negro, April-September.

four Mexican groups, and adjacent fall months (December and January) in two of the four white groups, all four of the Mexican groups, and two of the four negro groups. In all of these ten groups, each sex had a higher percentage of the yearly gain in one month and a lower percentage in the adjacent one. In each, the order of the higher and lower gain is reversed between the sexes. If the gains over the two adjacent months are combined, sex differences in them entirely disappear among the white children. In five other groups neither sex has over 3 per cent more of the gain in these adjacent months than does the other sex. In the remaining groups, two of Mexican boys and one of negro girls have respectively 6 per cent, 12 per cent, and 7 per cent more of their gain in December and January than do the groups of opposite sex in each case.

Summer gains among white boys and girls vary irregularly, the girls slightly exceeding the boys' gain once, equalling it once, and being less twice; but as was previously mentioned, when April gains are added to the following five-month period, sex difference is nil in three cases, and negligible in the fourth. Among Mexican children the girls consistently gain a little more of their yearly total in summer than do the boys in the corresponding group; but the gain of the negro boys was relatively a little more in summer than was that of the girls in three of four groups, and the girls exceeded the boys in the fourth group. In the last three fall months, the percentage of the yearly gain of the four groups of Mexican boys is in round numbers respectively 33, 28, 31, and 34, with corresponding percentages for the girls of 25, 24, 24, and 18 the reverse of the sex differences in summer. Among negroes, the girls' percentage of the yearly gain in the last three months was approximately the same as the boys' in two groups, and was more in two, the values in whole numbers being for boys 26, 24, 23, and 27, and for the girls 27, 31, 28, and 25 per cent.

The identical gains of white boys and white girls in three consecutive divisions of a 12-month period, February and March, April through September, and October through January, is contrary to the differential sex difference in seasonal variation reported by Palmer (17) for white school children of Hagerstown, Maryland. Palmer reports that his data "indicate that, although girls grow more rapidly than boys during the whole interval from the tenth to the fourteenth year, it is principally during the spring and summer that the velocities of growth for girls greatly exceed those for boys . . . .," and "that, although boys grow more rapidly than girls during the fourteenth and fifteenth years, it is principally during the fall and winter that rates for boys greatly surpass those for girls." An important difference in the two studies is that the gains of the Texas children are based on nude weights, whereas the weights used for the Maryland children were those determined in "regular indoor clothing" and "without shoes, vests, sweaters, and coats." Differences between maximum and minimum weights of clothing worn by white school children in Texas (22) have been found frequently to be ½ pound, ¾ pound, and

1 pound. Such magnitudes are comparable with the average monthly gain as recorded in Table 5. Few of the average gains even in October much exceed 1 pound. This contrast between the two studies indicates that the factor of clothing should have serious consideration in connection with the seasonal variation in weight.

Because of the identity of the white boys and girls in their seasonal variation of growth in weight, and the reversed positions of Mexican and negro boys and girls with respect to summer and fall gains, there appears to be no indication in the data of this study of an inherent sex difference in seasonal variation. Such small and inconsistent sex differences as appear must find explanation in some other factor.

Age Groups

The usual earlier beginning of adolescence in girls necessitates separate analysis for the two sexes by age groups in each race. The numbers com-

Table 7. Yearly gain in weight made by age groups

Sex	Age, years	White children				Mexican children				Negro children			
		1929		1930		1929		1930		1929		1930	
		No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.
Boys	6			2[1]						1			
	7	20	6.39	13	7.86	2		2		4		6	
	8	17	6.65	30	6.28	9	4.72	5		16	6.96	4	
	9	30	6.74	30	6.15	12	6.20	11	5.42	10	6.31	18	6.18
	10	29	8.80	28	6.99	23	6.60	15	6.82	9	6.49	14	6.41
	11	4		18	11.16	21	7.97	18	7.45	9	5.92	13	6.80
	12	2		4		15	8.97	17	7.29	11	11.18	14	10.13
	13					5		3		13	13.85	17	11.16
	14					4		1		8	13.27	12	15.06
	15					1		2		3		8	12.38
	16									2		1	
	All	102	7.29	125	6.84	92	7.69	74	7.19	86	9.18	107	9.10
Girls	5									1			
	6			4								1	
	7	18	6.47	17	5.17	1				9	6.12	3	
	8	20	8.07	19	5.80	7		5		12	5.63	11	5.72
	9	21	7.90	31	8.49	17	8.00	14	6.64	14	6.95	17	5.88
	10	14	10.04	22	9.78	23	10.42	25	9.64	19	11.56	6	8.58
	11	3		8	8.43	19	9.34	22	11.49	13	12.91	17	9.64
	12	1		1		10	10.46	18	10.23	21	11.11	12	10.05
	13			2		4		9	9.08	10	8.14	13	8.22
	14							3		11	6.92	5	
	15							1		5		7	
	16							1		4			
	17									1		1	
	All	77	8.27	104	7.88	81	9.18	98	8.68	120	8.66	93	7.24

[1]Calculations were made only for groups consisting of 8 or more individuals.

posing the several age groups in each sex of the three races, and the average 12-month gain per child in each group for each record year are shown in Table 7. Calculations were made only for groups consisting of 8 or more individuals. As is readily evident in the case of the negro children and the Mexican girls, the accelerated rise in yearly gain begins

Table 8. Growth in age groups by sex in each race as shown by average monthly and seasonal gains in relation to yearly gain and in comparison with that whole group of which each age group is a part

Race and sex	Record year	Group	No. of cases	Yearly gain, average per child	Average gain in pounds								Average gain as percentage of yearly gain										Average monthly percentage gain		
					In single month			In summer[1]	In single month				In single month							In seasons					
																				Spring	Summer	Fall			
					Feb.	Mar.	Apr.	May-Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Oct.	Nov.	Dec.	Jan.	3[2] months Feb.-Apr.	5[2] months May-Sept.	4 months Oct.-Jan.	Spring	Summer	Fall
White boys	1929	9 yr.	30	6.74	1.02	0.42	0.13	2.29	0.93	0.42	0.48	1.05	15.1	6.2	1.9	13.8	6.2	7.1	15.6	23.3	34.0	42.7	7.8	6.8	10.7
		10 yr.	29	8.79	1.54	0.17	0.68	3.03	1.11	0.44	0.44	1.38	17.5	1.9	7.7	12.6	5.0	5.0	15.7	27.2	34.5	38.3	9.1	6.9	9.6
		A+B, 7-12 yr.	102	7.29	1.09	0.43	0.42	2.38	1.05	0.37	0.56	0.99	15.0	5.9	5.8	14.4	5.1	7.7	13.6	26.7	32.7	40.8	8.9	6.5	10.2
	1930	9 yr.	30	6.15	0.31	0.82	−0.05	2.07	1.04	0.50	0.85	0.61	5.0	13.3	−0.8	16.9	8.1	13.8	9.9	17.6	33.7	48.8	5.9	6.7	12.2
		10 yr.	28	7.00	0.31	0.95	0.01	2.67	0.86	1.05	0.77	0.38	4.4	13.6	0.1	12.3	15.0	11.0	5.4	18.1	38.1	43.7	6.1	7.6	10.9
		A+C, 6-12 yr.	125	6.84	0.42	0.83	0.05	2.47	0.98	0.72	0.84	0.53	6.1	12.1	0.7	14.3	10.5	12.3	7.8	18.9	36.1	44.9	6.3	7.2	11.2
White girls	1929	9 yr.	21	7.91	1.07	0.62	0.21	2.35	1.19	0.39	0.78	1.30	13.5	7.8	2.7	15.0	4.9	9.9	16.4	24.0	29.7	46.3	8.0	5.9	11.6
		10 yr.	14	10.04	1.46	0.64	0.11	4.08	1.22	0.77	0.58	1.18	14.5	6.4	1.1	12.2	7.7	5.8	11.8	22.0	40.6	37.4	7.3	8.1	9.3
		A+B, 7-12 yr.	77	8.27	1.18	0.45	0.46	2.80	1.12	0.49	0.74	1.03	14.3	5.4	5.6	13.5	5.9	9.0	12.5	25.3	33.9	40.9	8.4	6.8	10.2
	1930	9 yr.	31	8.49	0.60	0.71	0.37	2.84	1.11	0.92	1.17	0.77	7.1	8.4	4.4	13.1	10.8	13.8	9.1	19.8	30.5	46.8	6.6	6.7	11.7
		10 yr.	22	9.78	0.74	0.80	0.62	2.81	1.58	1.39	1.15	0.69	7.6	8.2	6.3	16.2	14.2	11.8	7.1	22.1	28.7	49.2	7.4	5.7	12.3
		A+C, 6-13 yr.	104	7.88	0.59	0.78	0.41	2.34	1.41	0.85	0.16	1.34	7.5	9.9	5.2	17.9	10.8	2.0	17.0	22.6	29.7	47.7	7.5	5.9	11.9
Mexican boys	1929	9 yr.	12	6.20	0.99	0.55	−0.06	2.01	0.60	0.70	1.18	0.23	16.0	8.9	−1.0	9.7	11.3	19.0	3.7	23.9	32.4	43.7	7.9	6.5	10.9
		10 yr.	23	6.61	0.53	0.79	−0.04	2.22	0.78	0.97	1.04	0.32	8.0	12.0	−0.6	11.8	14.7	15.7	4.8	19.4	33.6	47.1	6.4	6.7	11.8
		A+B, 7-15 yr.	92	7.69	0.97	0.63	0.11	2.55	1.02	0.90	0.90	0.61	12.6	8.2	1.4	13.3	11.7	11.7	7.9	22.2	33.2	44.6	7.4	6.6	11.2
	1930	9 yr.	11	5.42	0.07	0.30	0.50	2.02	0.70	0.86	0.67	0.30	1.3	5.5	9.2	12.9	15.9	12.4	5.5	16.1	37.3	46.7	5.3	7.5	11.7
		10 yr.	15	6.82	0.55	0.49	0.22	2.50	1.07	1.69	−0.09	0.39	8.1	7.2	3.2	15.7	24.8	−1.3	5.7	18.5	36.7	44.9	6.2	7.3	11.2
		A+C, 7-15 yr.	74	7.19	0.35	0.65	0.21	2.49	1.02	0.63	1.14	0.70	4.9	9.0	2.9	14.2	8.8	15.9	9.7	16.8	34.6	48.6	5.6	6.9	12.1

[1]Summer 1929 for negro, April-September.
[2]For negroes, spring, February and March; Summer, April-September.

Table 8. Growth in age groups by sex in each race as shown by average monthly and seasonal gains in relation to yearly gain and in comparison with that whole group of which each age group is a part—Continued

Race and sex	Record year	Group	No. of cases	Yearly gain, average per child	Average gain in pounds								Average gain as percentage of yearly gain										Average monthly percentage gain		
					In single month			In summer[1]	In single month				In single month							In seasons					
																				Spring	Summer	Fall			
																				3[2] months	5[2] months	4 months			
					Feb.	Mar.	Apr.	May-Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Oct.	Nov.	Dec.	Jan.	Feb.-Apr.	May-Sept.	Oct.-Jan.	Spring	Summer	Fall
Mexican girls	1929	9 yr.	17	8.00	0.72	0.61	0.06	2.81	1.25	1.02	0.56	0.97	9.0	7.6	0.8	15.6	12.8	7.0	12.1	17.4	35.1	47.5	5.8	7.0	11.9
		10-12 yr.	52	10.03	1.27	0.85	0.10	4.27	1.42	0.78	0.56	0.78	12.7	8.5	1.0	14.2	7.8	5.6	7.8	22.1	42.6	35.3	7.4	8.5	8.8
		A+B, 7-13 yr.	81	9.18	1.15	0.62	0.18	3.66	1.34	0.75	0.62	0.86	12.5	6.8	2.0	14.6	8.2	6.8	9.4	21.3	39.9	39.0	7.1	8.0	9.7
	1930	9 yr.	14	6.65	0.82	0.35	0.26	2.29	0.81	0.62	0.53	0.97	12.3	5.3	3.9	12.2	9.3	8.0	14.6	21.5	34.4	44.1	7.2	6.9	11.0
		10-12 yr.	65	10.43	0.84	0.41	0.71	4.42	1.39	0.66	0.80	1.20	8.1	3.9	6.8	13.3	6.3	7.7	11.5	18.8	42.4	38.8	6.3	8.5	9.7
		A+C, 8-16 yr.	98	8.68	0.80	0.38	0.60	4.03	1.26	0.46	0.98	0.17	9.2	4.4	6.9	14.5	5.3	11.3	2.0	20.5	46.4	33.1	6.8	9.3	8.3
Negro boys	1929	9-11 yr.	28	6.24	0.15	0.29		3.32	0.90	0.20	0.61	0.77	2.4	4.7		14.4	3.2	9.8	12.3	7.1	53.2	39.7	3.5	8.9	9.9
		12-14 yr.	32	12.79	0.99	−0.09		7.44	1.47	0.73	0.44	1.81	7.7	−0.7		11.5	5.7	3.4	14.2	7.0	58.2	34.8	3.5	9.7	8.7
		A+B, 6-16 yr.	86	9.18	0.78	0.24		4.99	1.00	0.64	0.57	0.96	8.5	2.6		10.9	7.0	6.2	10.5	11.1	54.4	34.6	5.5	9.1	8.6
	1930	9-11 yr.	45	6.43	0.34	0.23	0.39	3.01	0.72	0.35	0.77	0.62	5.3	3.6	6.1	11.2	5.4	12.0	9.6	8.9	52.9	38.3	4.4	8.8	9.6
		12-14 yr.	43	11.91	0.63	0.21	0.72	5.94	1.20	1.20	1.86	0.15	5.3	1.8	6.1	10.1	10.1	15.6	1.3	7.1	55.9	37.0	3.5	9.3	9.3
		A+C, 7-16 yr.	107	9.10	0.56	0.23	0.54	4.32	0.94	0.75	1.33	0.43	6.2	2.5	5.9	10.3	8.2	14.6	4.7	8.7	53.4	37.8	4.4	7.9	10.9
Negro girls	1929	8-9 yr.	26	6.34	0.47	−0.02		3.80	0.46	0.63	0.62	0.38	7.4	−0.3		7.3	9.9	9.8	6.0	7.1	59.9	33.0	3.5	10.0	8.2
		10-12 yr.	53	11.71	0.84	0.29		6.40	1.02	0.80	1.69	0.67	7.2	2.5		8.7	6.8	14.4	5.7	9.7	54.7	35.7	4.8	9.1	8.9
		A+B, 5-17 yr.	120	8.66	0.69	0.14		4.35	1.03	0.74	0.97	0.74	8.0	1.6		11.9	8.6	11.2	8.6	9.6	50.2	40.3	4.8	8.3	10.1
	1930	8-9 yr.	28	5.81	0.39	0.47	0.20	2.87	0.67	0.30	0.68	0.23	6.7	8.1	3.4	11.5	5.2	11.7	4.0	14.8	52.8	32.4	7.4	8.8	8.1
		10-12 yr.	35	9.60	0.55	0.39	0.43	4.56	1.21	0.89	1.02	0.55	5.7	4.1	4.5	12.6	9.3	10.6	5.7	9.8	52.0	38.2	4.9	8.7	9.5
		A+C, 6-17 yr.	93	7.24	0.39	0.27	0.22	3.55	0.96	0.58	0.84	0.43	5.4	3.7	3.0	13.3	8.0	11.6	5.9	9.1	52.0	38.8	4.5	8.2	10.4

with the 10-year-old girls and with the 12-year-old boys. Owing to the nearly uniform gains made in a year by the slower gainers, and similarly by the faster gainers, it seemed logical to form two age groups for each sex of negro children—9-, 10-, and 11-year-old boys to compare with those 12, 13, and 14 years old, and 8- and 9-year-old girls to compare with 10-, 11-, and 12-year-olds. The slower gainers among the Mexican girls (9-year-olds) were compared with the faster gainers (10- to 12-year-olds). This comparison of the 9-year-olds with groups 3 and 4½ times as large seemed legitimate because the 10-year-old group alone had a distribution of gains almost identical with that of the 10-, 11-, and 12-year-olds together. Mexican boys and white children included too few of those in or approaching adolescence to show marked difference in a 12-month gain of age groups. Approximately ½ of the white children and 1/3 of the Mexican boys were in the 9-year and 10- year age groups. Considering these facts, only the 9- and 10-year-old white children and Mexican boys were chosen for this analysis.

The well recognized acceleration of growth which accompanies adolescence adds interest to the distribution through the year of gains referred to age. The distribution over the year of the average gains per child in the selected age groups in comparison with the gains of the total group from which the age groups were taken is shown in Table 8. A graphic presentation of these data is given in Figures 6, 7, and 8 respectively for white, Mexican, and negro groups. In general, the selected age groups in each sex of each race present a picture of growth which closely resembles that of the corresponding race and sex group which includes all ages. White children of the 9- and 10-year groups, like their all-ages group, made relatively more of their gain in the fall than in either spring or summer. Among both boys and girls the relationship between spring and summer rates of growth, as indicated by the average monthly percentage gain, is not consistent in the two record years when the 9-year-olds and 10-year-olds are compared. Some of the 9-year-old groups gained relatively more in spring than in summer and others less in spring than summer, and similarly for the 10-year-olds. Hence no distinctive age group differences in the seasonal gains can be pointed out from the behavior of these 9- and 10-year-old white boys and girls. Mexican boys of 9 and 10 years, like the white children, exhibit reversals of spring and summer rates in the two record years; but on the whole these 9- and 10-year-old Mexican groups conform to the general distribution of seasonal rates shown by the total number of Mexican boys.

The Mexican girls afford the only instance in which there is a fairly consistent difference in the performance of age groups. In both record years the 9-year-olds gained relatively more of their yearly increment to weight in the fall months than did the 10 to 12-year-olds. The average monthly gains in spring and summer as a percentage of the yearly gains for the 9-year-olds were closer to each other than either was to the gains made in the fall, while for the 10-year-olds average monthly percentage gains for summer and fall were closer to each other than either was to the

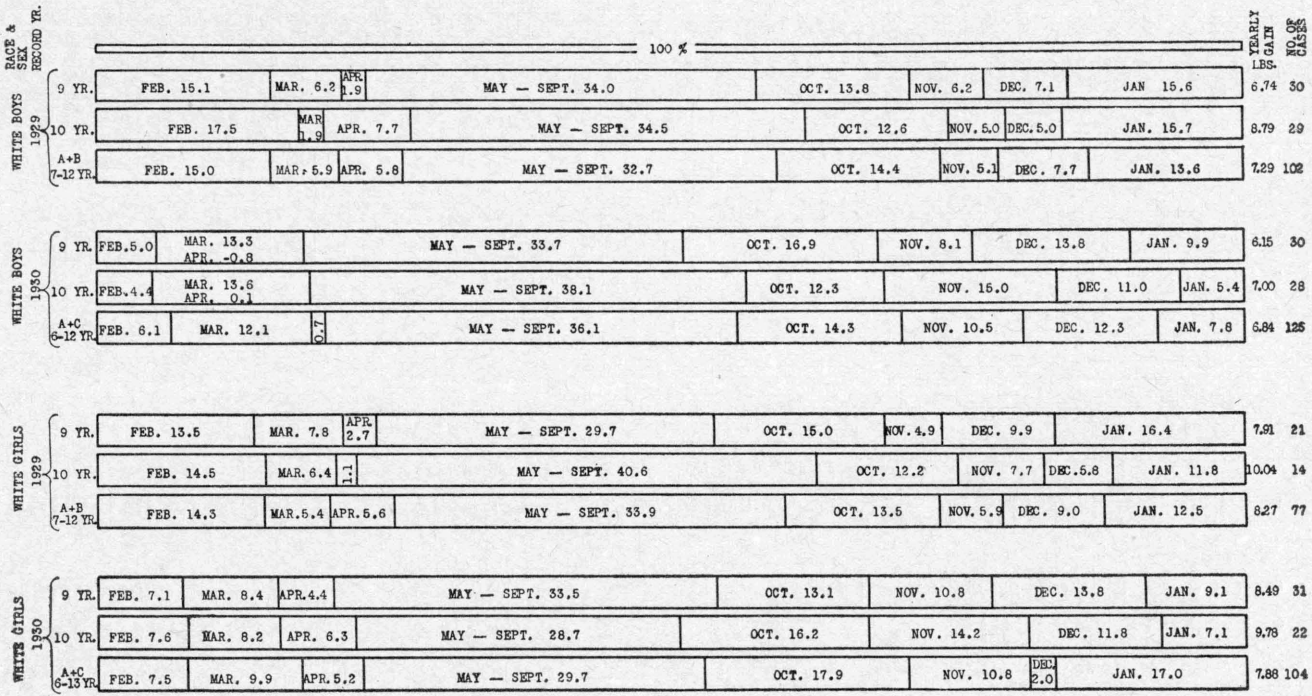

Fig. 6. Distribution of monthly and summer gains as percentage of the yearly gain made by selected age groups of white children in comparison with the corresponding "all age" group.

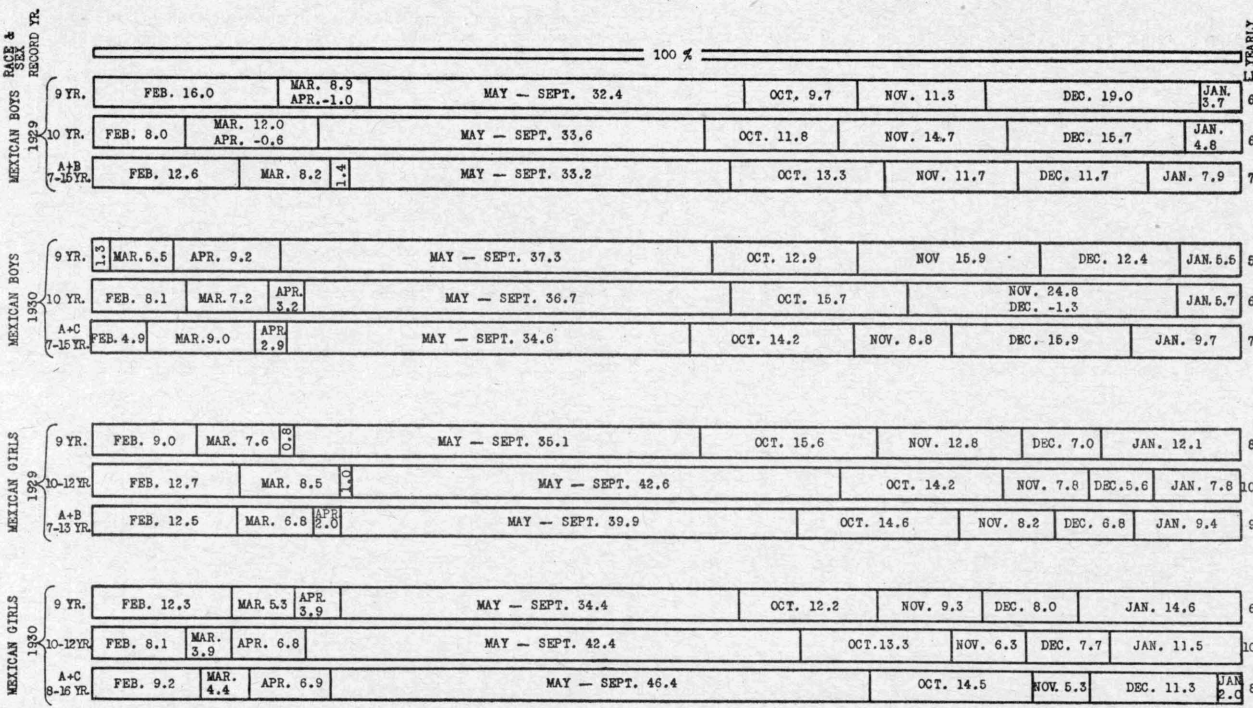

Fig. 7. Distribution of monthly and summer gains as percentage of the yearly gain made by selected age groups of Mexican children in comparison with the corresponding "all age" group.

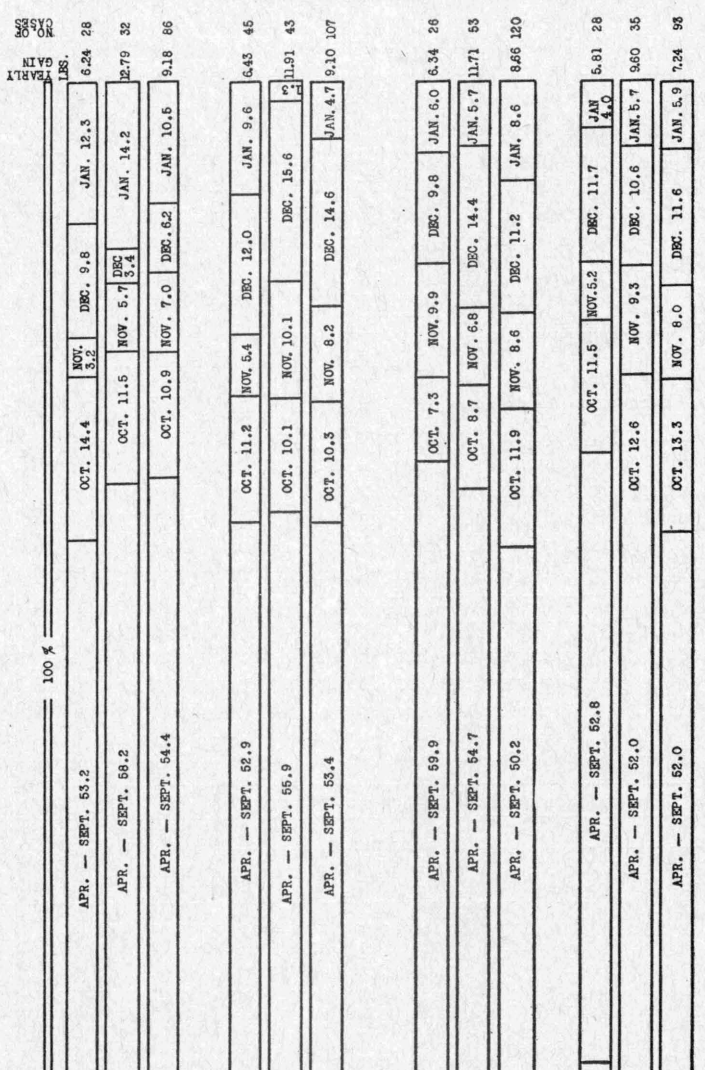

Fig. 8. Distribution of monthly and summer gains as percentage of the yearly gain made by selected age groups of negro children in comparison with the corresponding "all age" group.

gains made in the spring. These differences are small, however, and for this reason, as well as because of the very small numbers in the 9-year-old group, must not be regarded too seriously.

The most impressive picture is made by the negroes whose younger age group of each sex gained only about half as many pounds in a year as did the older group. Yet the distribution of the gains through the single months and summer, or through the three seasons, is essentially the same for each age group in each sex as for the whole number of negroes of the corresponding sex.

The findings in this study give no evidence that the age of a child is a factor in determining the distribution of a 12-month gain over the seasons of the year.

Birth-month Groups

The possibility presents itself that the time of year in which a child is born may have a bearing upon the rhythm of his gains through the cycle of successive seasons during his period of growth. It seemed worthwhile, despite the small numbers in each race group, to determine what light the data of this study would throw on this point. The children of each race, boys and girls together, were distributed into groups according to birth-month; the average yearly, monthly, and seasonal gains per child were calculated.

The birth-month groups together with their yearly gains are given in Table 9. The narrow deviations of the average yearly gain in the birth-month groups from the gain of the corresponding total group is noteworthy.

Table 9. Yearly gain in weight made by children grouped according to birth month

Birth month	White children				Mexican children				Negro children			
	1929		1930		1929		1930		1929		1930	
	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.	No. cases	Lbs.
Jan.	14	7.17	20	6.18	10	8.45	8	9.06	14	9.85	17	8.64
Feb.	19	6.77	26	7.80	15	11.15	22	9.63	20	8.02	16	8.43
Mar.	13	7.68	15	6.33	22	8.15	19	9.10	23	8.50	15	6.55
Apr.	6	12.00	15	7.36	10	8.81	13	7.04	11	9.52	12	8.20
May	10	7.84	30	9.24	14	8.76	11	9.00	26	9.06	26	8.82
June	17	7.93	21	7.70	13	9.28	11	9.01	10	6.99	12	6.63
July	16	7.62	19	6.62	9	4.82	13	8.52	22	9.94	21	10.09
Aug.	21	7.69	26	7.77	19	7.58	15	7.03	22	9.21	15	7.02
Sept.	18	7.93	15	7.48	17	8.19	16	7.99	16	9.82	18	8.24
Oct.	23	7.43	31	7.06	10	7.25	17	7.61	14	8.88	20	8.15
Nov.	13	7.90	12	6.79	16	9.17	15	10.40	15	8.85	13	8.40
Dec.	9	7.33	15	7.43	18	7.93	12	7.75	13	9.06	15	8.13
All months	179	7.71	229	7.32	173	8.39	172	8.05	206	8.87	200	8.23

In only 5 of the 72 birth-month groups, did the yearly gain differ by as much as 2 pounds or more from the average of the total group to which they belong. In view of this fact and of the results of the foregoing analyses, it was decided that a representative birth-month from each

Race	Record year	Group	No. of cases	Yearly gain, average per child,	Average gain in pounds								Average gain as percentage of yearly gain									
					In single month			In summer[1]	In single month				In single month							In seasons		
																				Spring	Summer	Fall
				Lbs.	Feb.	Mar.	Apr.	May-Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Oct.	Nov.	Dec.	Jan.	Feb.-Apr.[2]	May-Sept.[2]	Oct.-Jan.
White	1929	Feb.	19	6.77	1.18	0.09	0.42	2.54	1.34	-0.37	0.57	1.00	17.4	1.3	6.2	19.8	-5.5	8.4	14.8	24.9	37.5	37.5
		May	10	7.84	1.09	0.76	-0.05	2.63	1.12	0.37	0.39	1.53	13.9	9.7	-0.6	14.3	4.7	5.0	19.5	23.0	33.6	43.5
		Aug.	21	7.69	0.98	0.53	0.36	2.76	0.99	0.64	0.84	0.59	12.7	6.9	4.7	12.9	8.3	10.9	7.7	24.3	35.9	39.5
		Oct.	23	7.43	1.00	0.41	0.36	2.62	1.01	0.56	0.50	0.97	13.5	5.5	4.9	13.6	7.5	6.7	13.1	23.9	35.3	40.9
		A+B	179	7.71	1.13	0.44	0.44	2.56	1.08	0.42	0.64	1.00	14.7	5.7	5.7	14.0	5.5	8.3	13.0	26.1	33.2	40.7
	1930	Feb.	26	7.80	0.50	0.92	0.12	2.20	1.41	1.02	0.77	0.86	6.4	11.8	1.5	18.1	13.1	9.9	11.0	19.7	28.2	52.1
		May	14	9.24	0.90	0.89	0.33	3.77	1.02	0.79	0.84	0.70	9.7	9.6	3.6	11.0	8.6	9.1	7.6	22.9	40.8	36.3
		Aug.	26	7.77	0.75	0.87	-0.14	2.90	1.10	0.69	1.02	0.58	9.7	11.2	-1.8	14.2	8.9	13.1	7.5	19.1	37.3	43.7
		Oct.	31	7.06	0.51	0.87	0.19	2.10	1.20	0.82	0.94	0.43	7.2	12.3	2.7	17.0	11.6	13.3	6.1	22.5	29.8	48.0
		A+C	229	7.32	0.50	0.81	0.21	2.41	1.18	0.78	0.53	0.90	6.8	11.1	2.9	16.1	10.7	7.2	12.3	20.8	32.9	46.3
Mexican	1929	Feb.	15	11.15	1.26	1.28	-0.06	4.48	1.55	0.96	0.76	0.92	11.3	11.5	-0.5	13.9	8.6	6.8	8.3	22.3	40.2	37.6
		May	14	8.76	1.24	0.21	0.07	3.33	1.39	0.90	1.20	0.42	14.2	2.4	0.8	15.9	10.3	13.7	4.8	17.4	38.0	44.7
		Aug.	19	7.58	0.49	0.65	0.01	2.79	1.23	0.74	0.82	0.85	6.5	8.6	0.1	16.2	9.8	10.8	11.2	15.2	36.8	48.0
		Oct.	10	7.25	0.87	0.31	-0.19	2.76	1.15	0.49	0.76	1.10	12.0	4.3	-2.6	15.9	6.8	10.5	15.2	13.7	38.1	48.3
		A+B	173	8.39	1.06	0.62	0.14	3.08	1.16	0.83	0.78	0.72	12.6	7.4	1.7	13.8	9.9	9.3	8.6	21.7	36.7	41.6
	1930	Feb.	22	9.63	1.04	-0.15	0.56	3.67	1.50	0.65	1.08	1.28	10.8	-1.6	5.8	15.6	6.8	11.2	13.3	15.0	38.1	46.8
		May	11	9.00	0.60	0.32	0.41	3.07	1.57	0.87	1.33	0.83	6.7	3.6	4.6	17.4	9.7	14.8	9.2	14.9	34.1	51.0
		Aug.	15	7.03	0.68	0.44	0.06	3.05	1.02	0.61	0.77	0.40	9.7	6.3	0.9	14.5	8.7	11.0	5.7	16.9	43.4	39.8
		Oct.	17	7.61	0.49	0.38	0.28	2.45	1.58	1.30	0.31	0.82	6.4	5.0	3.7	20.8	17.1	4.1	10.8	15.1	32.2	52.7
		A+C	172	8.05	0.61	0.50	0.42	3.38	1.16	0.53	1.05	0.40	7.6	6.2	5.2	14.4	6.6	13.0	5.0	19.1	42.0	39.0
Negro	1929	Feb.	20	8.02	0.38	0.63	.....	4.43	0.96	0.17	0.74	0.71	4.7	7.9	.....	12.0	2.1	9.2	8.9	12.6	55.2	32.2
		May	26	9.06	0.53	0.22	.....	5.03	1.15	0.42	0.74	0.97	5.9	2.4	.....	12.7	4.6	8.2	10.7	8.3	55.5	36.2
		Aug.	22	9.21	1.05	0.12	.....	4.34	0.84	0.62	1.08	1.16	11.4	1.3	.....	9.1	6.7	11.7	12.6	12.7	47.1	40.2
		Oct.	14	8.88	0.41	0.30	.....	5.21	0.55	0.58	0.95	0.88	4.6	3.4	.....	6.2	6.5	10.7	9.9	8.0	58.7	33.3
		A+B	206	8.87	0.72	0.19	.....	4.62	1.01	0.70	0.80	0.83	8.1	2.1	.....	11.4	7.9	9.0	9.4	10.3	52.1	37.7
	1930	Feb.	16	8.43	0.17	0.45	0.60	4.16	0.71	0.50	1.22	0.62	2.0	5.3	7.1	8.4	5.9	14.5	7.4	14.8	49.0	36.2
		May	26	8.82	0.37	0.09	0.70	4.17	1.23	0.61	1.21	0.44	4.2	1.0	7.9	14.0	6.9	13.7	5.0	5.2	39.4	55.2
		Aug.	15	7.02	0.05	0.20	0.35	3.52	0.52	0.53	1.63	0.22	0.7	2.9	5.0	7.4	7.6	23.2	3.1	3.6	45.1	55.1
		Oct.	20	8.15	0.80	0.43	0.74	2.94	1.08	0.84	0.94	0.38	9.8	5.3	9.1	13.3	10.3	11.5	4.7	15.1	45.2	39.8
		A+C	200	8.23	0.48	0.24	0.39	3.97	0.95	0.67	1.10	0.43	5.8	2.9	4.7	11.5	8.1	13.4	5.2	8.8	53.0	38.3

[1]Summer 1929 for negro, April-September
[2]For negroes, spring, February and March; summer, April-September

season should be selected for this analysis. February, May, August, and October appeared satisfactory from the standpoint of numbers when all three races and both record years were taken into account. The average yearly gains per child appropriately divided among the months and seasons and the like data of the corresponding total group are recorded in Table 10. These data, especially the gains of the three seasons as a percentage of the yearly gain show more consistent results for the record year of 1929 than for 1930. Among white, Mexican, and negro children alike, the four selected birth-month groups in 1929 have a close resemblance to each other and to their respective total groups in the percentage of the yearly gain made in each season. Variations of the different birth-months from the total group are not at all consistent between the two record years. Greater likeness exists, on the whole, among the four birth-month groups in 1929 than between the same birth-month groups in the two record years.

It seems justifiable, therefore, to conclude that the data of this study indicate that the time of year in which a child is born is not a factor in determining any seasonal rhythm in his growth in weight.

Body-build Groups

The type of body-build of children has been found by others to be correlated with their yearly gain in weight. According to the most recent weight-height-age tables of Baldwin and Wood (2), short, stocky (white) children of a given age may be expected to gain less than those of medium build, and medium in turn less than tall slender children, until the maximum yearly gain of the tall group is reached. Short children continue to gain less than medium in each year of age until those of medium build achieve their maximum yearly gain. Whether children of differing body-build distribute their gains through the year in like or unlike fashion is a question that naturally follows. The data of this study were examined from the viewpoint of body-build as related to seasonal variation of gains in weight.

The index of body-build for each child was calculated in a manner similar to that recently used by Lucas and Pryor (12). The index was derived by dividing the width of hips in centimeters by the standing height in centimeters, and multiplying by 1000 to provide a more convenient working figure. In this study the width of hips was measured with the greater trochanter as the landmark whereas Lucas and Pryor used the iliac crest. The higher the hip-height index, the more stocky the individual. Such an index permits direct comparison of the two sexes and different ages. The largest group of children, A+B for 1929, and A+C for 1930, was divided into 3 parts on the basis of body-build index, thus separating the 25 per cent of most slender build (lowest index) in each group from the middle 50 per cent, and from the upper 25 per cent of most stocky children (highest index group). The yearly gain and the monthly and seasonal gains were then calculated for each body-build group. These data, shown in Table 11, reveal the gains as a percentage of the yearly gain for both

Table 11. Seasonal variation of growth in weight as shown by monthly and seasonal gains in relation to yearly gain of children grouped according to body-build index[1]

Race	Record year	Body-build index[1]	No. of cases	Yearly gain		Total gain of group in pounds								Total gain of group as percentage of yearly gain									
						In single month			In summer[2]	In single month				In single month							In seasons		
				Av. per child	Group total	Feb.	Mar.	Apr.	May-Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Oct.	Nov.	Dec.	Jan.	Spring Feb.-Apr.[2]	Summer May-Sept.[2]	Fall Oct.-Jan.
				Lbs.	Lbs.																		
White	1929	160 or less	46	6.82	313.94	60.50	24.32	11.68	109.38	40.94	14.00	31.50	21.62	19.3	7.8	3.7	13.0	4.5	10.0	6.9	30.8	34.8	34.4
		170 - 179	86	7.26	624.50	87.50	32.25	42.06	188.19	100.56	37.57	48.50	87.87	14.0	5.2	6.7	16.1	6.0	7.8	14.1	25.9	30.1	43.9
		180 or more	47	8.97	421.62	53.37	29.88	17.12	161.19	50.87	24.07	34.18	50.94	12.7	7.1	4.1	12.1	5.7	8.1	12.1	23.9	38.2	38.0
	1930	169 or less	55	6.07	333.68	27.06	35.50	6.31	108.81	54.63	31.75	38.69	30.93	8.1	10.6	1.9	16.4	9.5	11.6	9.3	20.6	32.6	46.8
		170 - 179	120	7.09	850.88	53.19	94.19	20.37	278.50	137.38	93.87	92.50	80.88	6.3	11.1	2.4	16.2	11.0	10.9	9.5	19.8	32.7	47.6
		180 or more	51	9.24	471.19	31.44	54.44	19.87	162.44	77.00	49.31	-12.93	89.62	6.7	11.6	4.2	16.6	10.5	-2.7	19.0	22.5	34.5	43.4
Mexican	1929	174 or less	52	7.73	401.75	49.56	32.75	7.82	136.62	56.25	37.50	36.94	44.31	12.3	8.2	2.0	14.0	9.3	9.2	11.0	22.3	34.0	43.5
		175 - 184	86	7.67	659.25	89.00	55.69	6.06	223.07	88.56	79.37	72.25	45.25	13.5	8.5	0.9	13.4	12.0	11.0	6.9	22.9	33.8	43.3
		185 or more	35	11.15	390.19	43.50	25.62	4.44	172.69	56.69	26.75	24.25	36.25	11.2	6.6	1.1	14.5	6.9	6.2	9.3	18.9	44.3	36.9
	1930	174 or less	58	6.65	385.57	12.32	32.25	24.31	153.19	44.00	42.87	36.25	40.38	3.2	8.4	6.3	11.4	11.1	9.4	10.5	17.9	39.7	42.4
		175 - 184	71	8.37	594.38	57.19	35.94	17.00	233.62	74.00	54.19	60.94	62.50	9.6	6.1	2.9	12.5	9.1	10.3	10.5	18.6	39.3	42.4
		185 or more	43	11.35	488.06	35.37	17.25	31.13	193.44	81.50	30.93	47.25	51.19	7.3	3.5	6.4	16.7	6.3	9.7	10.5	17.2	39.6	43.2
Negro	1929	169 or less	54	9.26	499.81	43.63	16.62	....	242.94	58.25	27.31	46.94	64.12	8.7	3.3	....	11.7	5.5	9.4	12.8	12.0	48.6	39.4
		170 - 179	81	8.65	700.94	61.94	23.00	....	384.81	58.38	52.00	61.94	58.87	8.8	3.3	....	8.3	7.4	8.8	8.4	12.1	54.9	32.9
		180 or more	71	8.84	627.56	43.50	-1.25	....	323.12	91.94	65.75	55.62	48.88	6.9	-0.2	....	14.7	10.5	8.9	7.8	6.7	51.5	41.9
	1930	169 or less	67	8.65	579.69	36.31	12.00	33.57	290.43	68.57	43.93	70.94	23.94	6.3	2.1	5.8	11.8	7.6	12.2	4.1	8.4	55.9	35.7
		170 - 179	90	8.37	753.00	46.00	32.44	30.25	353.37	79.57	53.37	109.75	48.25	6.1	4.3	4.0	10.6	7.1	14.6	6.4	10.4	50.9	38.7
		180 or more	43	7.31	314.12	12.75	5.81	14.37	148.38	42.25	36.62	39.88	14.06	4.1	1.9	4.6	13.5	11.7	12.7	4.5	6.0	51.8	42.4

[1]Body-build index = $\frac{\text{width of hips in cm} \times 1000}{\text{standing height in cm}}$

[2]For negro, 1929, summer, April-September; spring, February and March

single months and seasons to be markedly alike for the three body-build groups within each race for a given record year. Such irregularities as do occur, and these are more common among the negroes than among white and Mexican children, do not consistently distinguish the body-build groups in the two record years.

This study, therefore, indicates that the natural body-build of a child, whether stocky, medium, or slender, is not a factor in determining seasonal variation in weight gains.

Living Conditions

The possibility is recognized that the physical conditions under which a child lives may have a share in determining his course of growth. Conceivably, the home environment might either provide utter freedom for the inherent growth impulse to express itself, or, if unfavorable, interfere with the natural growth processes. Mitchell (14), reporting a study made by the American Child Health Association with Porto Rican school children, gives evidence of the influence of socio-economic factors upon growth and development. Within the urban group of the Porto Rican children, those from homes having the larger number of rooms and the fewer persons per room showed a tendency to be taller, to have greater hip width, larger arm girth, and greater amounts of subcutaneous tissue over the biceps than did children from smaller and more crowded homes. The rural children did not exhibit similar consistent tendencies in the relation of physical development to socio-economic status. Mitchell suggests that the same rating scales as used for the urban children did not distinguish rural families in important socio-economic ways, and that there may be no important differences in the mode of living of various rural classes in a manner to effect the children's growth.

The children who were weighed the last year of this study with Texas school children answered questions as to the number of persons in their respective families and the number and purpose of the rooms in the house in which they lived. From their answers, two indications of living conditions have been evolved—the average number of rooms per person in the house, and the presence or absence of a bathroom. These are recognized as inadequate indications of housing conditions in themselves, yet the speculation is probably permissible that in general more physical comforts and conveniences of living were available to those children who lived under less crowded conditions than to those less fortunate in this respect. The figures in Table 12 show that the white children had more living space in their homes than either Mexican or negro children, in so far as this can be judged by the average number of rooms per person. Less than 1/3 of the white group had as little as 1 room or less per person, while over 4/5 of the Mexican group and nearly ¾ of the negro group lived in homes with an average of 1 room or less per person. Only 3 white children out of 243 (1 per cent) had no bathroom, while over 1/3 of the Mexican and approximately ½ of the negro had none. Ten white children had 2 bathrooms in their homes, but no Mexican or negro home had more than 1 bathroom.

Table 12. Living conditions as indicated by average number of rooms per person and number of bathrooms in homes of the three race groups

Race	Total No.	Proportion of group with homes providing rooms as shown															
		Average number of rooms per person										Bathrooms					
		0.1-0.5		0.6-1.0		1.1-1.5		1.6-2.0		2.1 & +		None		One		Two	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
White	243	3	1.2	72	29.6	102	42.0	44	18.1	22	9.1	3	1.2	230	94.7	10	4.1
Mexican	197	66	33.5	105	53.3	22	11.2	2	1.0	2	1.0	70	35.5	127	64.5	0	
Negro	254	51	20.1	130	51.2	52	20.5	17	6.7	4	1.6	125	49.2	129	50.8	0	

While it has already been shown that the three races in general display the same seasonal variation in growth, it was thought worth while to determine whether difference within each race group existed with reference to the two indications of living conditions. Table 13 shows the seasonal distribution of weight gains as a percentage of the yearly gain for the

Table 13. Seasonal distribution of weight gains in relation to two indications of living conditions

Race	Record year	Living condition: Average no. rooms per person	No. of cases	Yearly gain: Av. per child, Lbs.	Percentage of yearly gain made in: Spring[1] Feb.-Mar.	Spring[1] April	Summer[1] May-Sept.	Fall Oct.	Fall Nov.-Jan.
White	1929	1 or less	27	7.23	21.3	0.5	39.7	12.4	26.1
		1.1-1.5	45	7.27	21.2	5.9	31.1	16.7	25.1
		1.6-2.0	18	6.92	14.4	7.2	34.3	11.3	32.8
		2.1 & +	14	8.00	17.0	10.1	31.1	16.4	25.4
	1930	1 or less	66	7.28	16.4	2.3	36.1	17.8	27.3
		1.1-1.5	91	7.48	19.0	2.9	30.7	16.2	31.3
		1.6-2.0	42	6.94	19.7	0.4	33.8	16.0	30.0
		2.1 & +	20	6.89	12.5	7.3	42.4	5.4	32.4
Mexican	1929	0.5 or less	31	6.86	19.2	—1.1	35.1	16.2	30.6
		0.6-1.0	51	8.38	19.7	1.6	34.6	14.6	29.5
		1.1-1.5	13	8.85	18.8	5.6	47.7	10.6	17.4
		1.6 & +	1	8.69					
	1930	0.5 or less	55	8.37	13.3	5.3	43.7	11.8	26.0
		0.6-1.0	91	8.93	12.3	4.1	39.1	14.1	30.4
		1.1-1.5	17	7.71	14.8	9.2	36.8	13.1	26.1
		1.6 & +	4	8.61					
Negro	1929	0.5 or less	33	8.94	8.4	...	53.6	13.2	24.8
		0.6-1.0	88	8.75	12.4	...	53.8	10.2	23.7
		1.1-1.5	27	10.19	7.1	...	51.2	12.7	29.1
		1.6 & +	15	8.41	5.6	...	47.7	10.2	36.5
	1930	0.5 or less	33	6.68	9.8	3.3	51.9	14.8	20.3
		0.6-1.0	103	8.12	8.0	6.5	48.0	9.9	27.6
		1.1-1.5	44	9.68	10.4	2.9	48.0	12.4	26.4
		1.6 & +	14	6.69	3.9	2.5	44.7	14.0	34.8
Mexican	1929	Bath with	65	8.37	19.4	2.7	38.7	12.6	26.6
		Bath without	31	7.09	19.3	—2.3	32.7	18.8	31.5
	1930	Bath with	106	8.80	13.9	5.2	39.4	13.2	28.3
		Bath without	61	8.29	11.4	4.1	40.8	14.3	29.4
Negro	1929	Bath with	80	9.23	7.4	...	54.3	11.8	26.5
		Bath without	83	8.77	12.7	...	51.2	10.7	25.5
	1930	Bath with	100	8.33	8.0	4.6	47.9	10.6	28.9
		Bath without	94	7.91	9.4	5.1	48.9	12.5	24.2

[1]For negro children, spring 1929, February and March; summer 1929, April-September.

children in each race grouped according to the average number of rooms per person, and for the Mexican and negro children according to whether their houses have or have not a bathroom. It is evident that within each race and each record year the groups based on either of the two housing conditions made essentially the same proportion of their gain in a given season, confirming the results of other analyses in this study. Such irregularities as appear are not consistent as between the two record years

in any race group, and they are probably no greater than would be expected with such small numbers constituting the groups. It is possible that the difference between the poorest and best degrees of living comfort implied by the average number of rooms and the presence or absence of a bathroom in the homes of these children, is not great enough to be reflected in the total growth and the seasonal variation in growth. But in so far as data of this study afford an indication, it is that differences in living comforts did not influence seasonal variation in growth.

Constancy of Gain

As was previously mentioned, all children in each race whose every weight change throughout one record year, whether for one month or the summer period, was a gain or zero were selected for examination individually, as well as in a group. This group (group X) included in all 95 children, 3 of whom had a record in both record years, so that 98 individual records were available. Out of the 899 children who had complete records, about 10 per cent of the negro, 10 per cent of the Mexican, and 12½ per cent of the white children were included in this group X. Despite the surprisingly small proportion of children who met this basis of selection, the groups appear representative from standpoints of age, birth-month, and equal number of the two sexes. In this selection, the records in which the time of day for weighing changed once or twice in the course of the year were retained, provided the weight change was comparable with other changes in the child's record. These changes (12 for white, 10 for Mexican, and 3 for negro children) derived from different time-of-day weighings are marked * in the records of individual gains (Tables 15, 16, and 17).

As a Group. The data for group X considered en masse for each race are presented in Table 14 and in Figures 9 and 10. Owing to the small number of records and to the similarity of the two record years in foregoing analyses, all records of both 1929 and 1930 for each sex and race group were pooled. The average gain in pounds per child was calculated for each weighing interval, and also the percentage of the yearly gain made in the single months of the weighing schedule and in the three seasons of the record year.

This analysis serves in the main to confirm the results obtained with groups A, A+B, and A+C. Again, the distribution of gains through the year is strikingly similar for the three races in that (1) the four fall months together constitute the best gaining season of the three, and the percentage of the yearly gain made in the fall is practically the same for the three races; (2) the races maintained the same order among themselves as before in the relative gains of spring and summer; and (3) the similarity in the course of growth of the two sexes in each race is even more pronounced in group X than in others used previously. For negro boys and girls the distributions are almost alike. October and April in group X are less conspicuous than in group A, A+B, and A+C. October is consistently an excellent gaining month, but with the exception

Table 14. Seasonal variation of growth in weight as shown by average monthly and seasonal gains in relation to yearly gain of children who were constant gainers (group X)

Race	Record year	No. of cases	Sex	Yearly gain	Average gain in pounds								Average gain as a percentage of yearly gain										Average monthly percentage gain		
					In single month			In summer[1]	In single month				In single month							In seasons					
																				Spring 3[2] mo.	Summer 5[2] mo.	Fall 4 mo.			
					Feb.	Mar.	Apr.	May-Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	Oct.	Nov.	Dec.	Jan.	Feb.-Apr.	May-Sept.	Oct.-Jan.	Spring	Summer	Fall
White	1929	15	Boys	7.61	0.99	0.78	0.69	1.60	1.08	0.61	0.92	0.94	13.0	10.3	9.1	14.2	8.0	12.1	12.4	32.4	21.0	46.7	10.8	4.2	11.7
	1930	5																							
	1929	7	Girls	12.21	1.58	1.25	0.85	3.24	1.48	1.16	1.31	1.34	12.9	10.2	7.0	12.1	9.5	10.7	11.0	30.1	26.5	43.3	10.0	5.3	10.8
	1930	15																							
			Both	10.02	1.30	1.02	0.77	2.47	1.28	0.90	1.13	1.15	13.0	10.2	7.7	12.8	9.0	11.3	11.5	30.9	24.7	44.4	10.3	4.9	11.1
Mexican	1929	9	Boys	10.50	1.04	0.87	0.70	3.18	1.29	0.94	0.80	1.68	9.9	8.3	6.7	12.3	9.0	7.6	16.0	24.9	30.3	44.9	8.3	6.1	11.2
	1930	5																							
	1929	8	Girls	13.05	1.40	1.01	0.67	4.49	1.58	0.98	1.38	1.54	10.7	7.7	5.1	12.1	7.5	10.6	11.8	23.6	34.4	42.0	7.9	6.9	10.5
	1930	6																							
			Both	11.77	1.22	0.94	0.68	3.84	1.44	0.96	1.08	1.61	10.4	8.0	5.8	12.2	8.2	9.2	13.7	24.2	32.6	43.3	8.1	6.5	10.8
Negro	1929	11	Boys	13.86	1.27	0.53	.....	6.20	1.41	1.13	1.67	1.65	9.2	3.8	.....	10.2	8.2	12.1	11.9	13.0	44.7	42.3	6.5	7.4	10.6
	1930	3																							
	1929	11	Girls	12.86	0.85	0.88	.....	5.39	1.60	1.17	1.49	1.48	6.6	6.8	.....	12.4	9.1	11.6	11.5	13.5	41.9	44.6	6.7	7.0	11.1
	1930	3																							
			Both	13.54	1.06	0.71	.....	5.79	1.50	1.16	1.58	1.74	7.8	5.2	.....	11.1	8.6	11.7	12.9	13.0	42.8	44.3	6.5	7.1	11.1

[1]For negroes, 1929, April-September
[2]For negroes, spring, February and March; summer, April-September

of the Mexican boys, December and January are approximately as good as October, and November is only a little inferior to the other three fall months in its share of the yearly gain. April, while the poorest single month in the weighing schedule, is distinctly less than 1/12 of the yearly gain in only one group out of four. March and February also show gains fairly comparable within each race with those of November or October. Because of these better gains in spring months, spring and summer for the white children show greater differences in relative rates

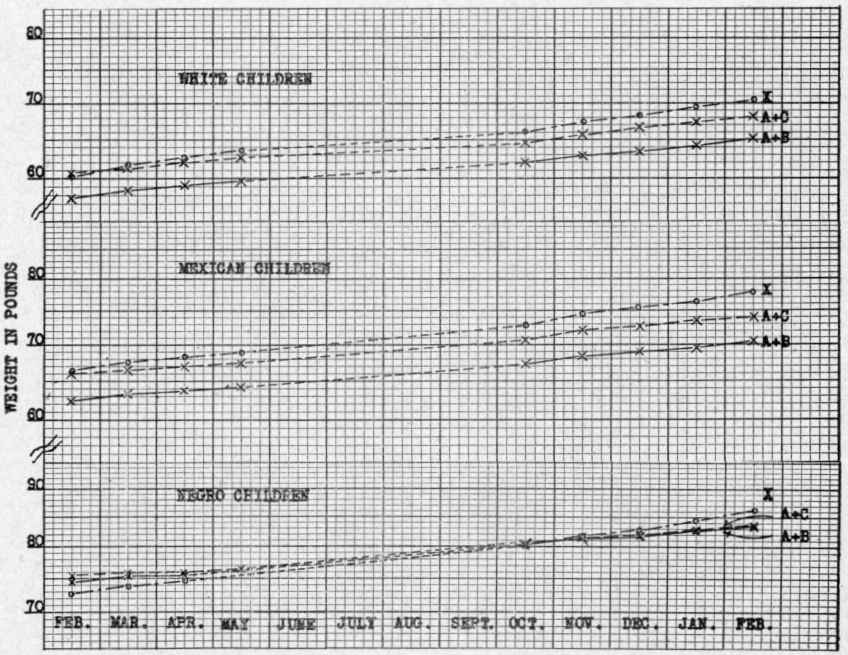

Fig. 9. Curves of growth. Group average weights. Complete record cases (A+B and A+C) compared with constant gainers (X).

of gain than in groups A, A+B, and A+C, the poor rate in summer being thus accentuated. In group X, the Mexicans' gains in spring were slightly greater than the gains in summer, whereas in their other groups, gains in summer equalled or slightly surpassed those in spring. The spring and summer gains of negroes differ less in group X than in their other groups but in the same direction, with a slightly higher rate in summer than in spring.

As Individuals. From the records of individual gains of each child, shown in Tables 15, 16, and 17 for white, Mexican, and negro children respectively, the average monthly gain was calculated in pounds and ounces to the nearest 0.5 ounce for each of the three seasons. The seasonal interrelation-

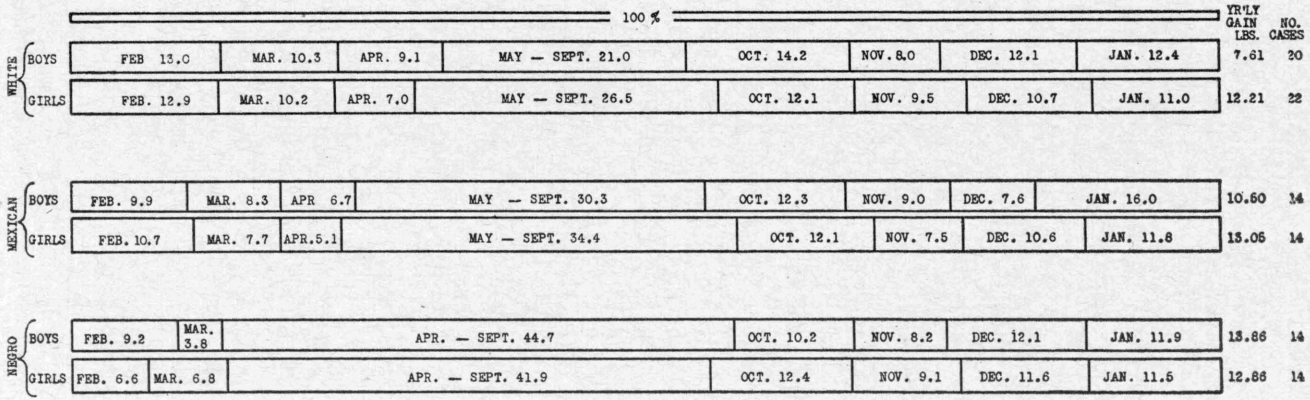

Fig. 10. Distribution of monthly and summer gains as percentage of the yearly gain made by the boys and the girls who were constant gainers in each race.

Race and sex	Record year	Case No.	Birth month	Age, years	Feb. Mar.	Mar. Apr.	Apr. May	Sept. Oct.	Oct. Nov.	Nov. Dec.	Dec. Jan.	Jan. Feb.	Feb. Jan.	Feb. Apr.	May Sept.	Oct. Jan.	Feb. Apr.	May Sept.	Oct. Jan.	average rate of gain		
													12 mo.	3 mo.	5 mo.	4 mo.	Spring	Summer	Fall	Spring minus fall	Summer minus spring	Summer minus fall
					lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz			
White boys	'29	100	Nov.	12	2-14	1-14	*0-1*		1-14	1-5	**3-1**	1-9*[2]	14-2	4-13	1-8	7-13*	1-10	0-5	1-15	—	—	—
	'29	271	Dec.	8	*0-2*	*0-2*	0-7		1-7	0-4	1-12	**2-3**	10-8	0-11	4-3	5-10	0-4	0-13	1-6.5	—	+	—
	'29	246	Sept.	7	1-9	0-9	0-6		1-11	*0-0*	0-9	**2-0**	7-1	2-8	0-5	4-4	0-13	0-1	1-1	—	—	—
	'30	90	Dec.	8	0-12	*0-2*	1-6*		0-14	1-1	0-10	**1-11**	7-1	2-4*	0-9	4-4	0-12	0-2	1-1	—	—	—
	'30	73	Feb.	9	0-4	1-14	0-12		**2-5**	0-15	0-14	*0-3*	8-3	2-14	1-0	4-5	0-15	0-3	1-1	—	—	—
	'30	69	June	11	1-0	1-8	*0-3*		**1-14**	0-9	0-7	0-15	8-7	2-11	1-15	3-13	0-14	0-6	0-15	—	—	—
	'29	220	July	10	0-1	*0-0*	0-11		1-0	0-6	0-12	**1-6**	6-0	0-12	1-12	3-8	0-4	0-5.5	0-14	—	+	—
	'30	322	July	8	1-0	*0-0*	0-3		*0-0*	0-9	1-3	**1-10**	4-15	1-3	0-6	3-6	0-6	0-1	0-13.5	—	—	—
	'29	243	June	8	0-3	0-15	0-4		1-0	**1-7**	*0-2*	0-8	5-7	1-6	1-0	3-1	0-7	0-3	0-12	—	—	—
	'29	283	July	7	0-6	0-14	0-5		0-11	*0-2*	**1-1**	0-14	**6-15**	**1-9***	**2-10***	2-12	0-8	0-8	0-11	—	=	—
	'29	428	Jan.	9	**1-5**	0-8	*0-0*		0-12	0-3	1-3	0-8	6-14	1-13	2-7	2-10	0-10	0-8	0-10.5	—	—	—
	'29	152	Jan.	9	0-2	*0-0*	*0-0*		0-11	**1-1**	0-2	0-7	3-10	0-2	1-3	2-5	0-0.7	0-4	0-9	—	+	—
	'29	47	Jan.	7	2-5*	1-0	*0-4*		**1-8**	0-8	1-2	1-3	8-8	3-9*	0-10*	4-5	1-3	0-2	**1-1**	+	—	—
	'29	261	May	10	1-4	1-4	*0-8*		1-1	*0-8*	0-9	**1-10**	11-4	3-0	4-8	3-12	1-0	0-14	0-15	+	—	—
	'29	182	July	9	**3-14**	0-7	1-0		1-5	*0-1*	1-11	0-8	9-12	5-5	0-14	3-9	1-12	0-3	0-14	+	—	—
	'29	123	Jan.	9	**1-12**	0-5	1-3		1-11	0-14	0-7	*0-4*	7-9	3-4	1-1	3-4	1-1	0-3.5	0-13	+	—	—
	'29	193	Aug.	7	0-0*	*0-5*	**1-14**		0-9	0-8	1-11	*0-5*	8-4	2-3*	3-0*	3-1	0-12	0-9.5	0-12	=	—	—
	'29	239	Oct.	7	*0-2*	**1-5**	**1-13**		**1-2**	**0-5**	**0-13**	0-5	7-4	3-4	1-7	2-9	1-1	0-4.5	0-10	+	—	—
	'30	141	Feb.	8	0-7	**1-8**	0-6		*0-2*	1-4	*0-2*	0-3	5-4	2-5	1-2	1-13	0-12	0-3.5	0-7	+	—	—
	'29	90	Dec.	7	0-9	0-15	**2-3**		*0-1*	0-4	0-4	0-7	5-5	3-11	0-10	1-0	1-4	0-2	0-4	+	—	—
White girls	'29	244	Apr.	10	4-0	0-13	*0-1*		**5-5**	2-1	1-0	3-4	19-11	4-14	3-3	11-10	1-10	0-10	2-14.5	—	—	—
	'29	40	Aug.	8	4-0	*0-12*	1-9		**4-8**	1-11	1-5	1-15	20-3	6-5	5-9	9-7	2-2	1-2	2-6	—	—	—
	'30	74	Sept.	10	1-7	1-9	0-15		2-4	*0-1*	**2-7**	2-2	10-15	3-15	0-2	6-14	1-5	0-0.4	1-11.5	—	—	—
	'29	36	June	9	2-3	1-6	*0-12*		0-15	1-2	**2-14**	1-10	13-2	4-5	2-4	6-9	1-7	0-7	1-10	—	—	—
	'30	247	Sept.	9	*0-2*	1-1	1-2		**2-14**	1-8	0-10	0-15	8-7	2-5	0-3	5-15	0-12.5	0-0.6	1-8	—	—	—
	'30	251	July	8	1-1	0-9	0-1*		1-4	1-7	*0-7*	2-2	7-11	1-11*	0-12	5-4	0-9	0-2.5	1-5	—	—	—
	'30	49	June	10	1-7	1-6	0-12		0-8	**2-12**	1-11	*0-0*	13-12	3-9	5-4	4-15	1-3	1-1	1-4	—	—	—
	'30	163	Aug.	9	0-15	*0-11*	0-14*		0-13	1-4	**2-0**	0-12	11-2	2-8*	3-13	4-13	0-13	0-12	1-3	—	—	—
	'30	44	Oct.	10	0-11	1-14	0-7		*0-0*	1-0	1-0	**2-12**	11-1	3-0	3-5	4-12	1-0	0-10.5	1-3	—	—	—
	'29	26	Aug.	7	2-1*	0-8	*0-4*		**1-8**	0-11	1-6	0-14	8-11	2-13*	1-7	4-7	0-15	0-4.5	1-2	—	—	—
	'30	61	Oct.	10	*0-0*	0-12	0-6		**1-8**	0-13	0-11	1-2	8-8	1-2	3-4	4-2	0-6	0-8	1-0.5	—	+	—
	'30	275	Dec.	10	*0-1*	0-11	1-5*		0-4	**2-0**	1-2	0-10	8-6	2-1*	2-5	4-0	0-11	0-7	1-0	—	—	—
	'30	87	Mar.	7	**0-14**	0-7	*0-0*		0-11	*0-0*	0-13	0-7	5-1	1-5	1-13	1-15	0-7	0-6	0-8	—	—	—
	'30	120	Feb.	7	0-8	0-15	*0-1*		0-9	0-5	**1-3**	0-8	5-10	1-8	1-9	2-9	0-8	0-5	0-10	—	—	—
	'30	130	May	13	1-8	**6-15**	2-2		3-12	0-15	4-12	*0-14*	31-14	10-9	11-0*	10-5	3-8	2-3	2-9	+	—	—
	'29	20	Apr.	10	**2-15**	2-4	0-8		**0-6**	**2-14**	*0-4*	**2-15**	19-8	5-11	7-6	6-7	1-14	1-7.5	1-10	+	—	—
	'30	40	Aug.	9	**3-6**	1-4	*1-2*		1-14	1-9	1-13	1-5	21-5	5-12	8-2	6-5	1-15	1-10	1-9	+	—	—
	'29	22	June	11	2-6	1-1	2-9		0-13	1-13	*0-5*	**2-11**	13-14	6-0	2-4*	5-10	2-0	0-7	1-6.5	+	—	—
	'30	122	July	9	**2-14**	0-10	1-6		*0-4*	0-12	2-4	0-9	12-14	4-14	4-3	3-13	1-10	0-13	0-15	+	—	—
	'30	276	Mar.	8	0-13	0-11	1-0		1-3	*0-3*	0-5	**1-4**	6-4	2-8	0-13	2-15	0-13	0-2.5	0-12	+	—	—
	'29	90	Mar.	7	0-15	0-5	0-11		**1-7**	0-7	0-3	*0-1*	5-1	1-15	1-0	2-2	0-10	0-3	0-8.5	+	—	—
	'30	1	Aug.	9	0-8	**1-0**	0-13*		*0-1*	0-4	0-8	0-10	5-8	2-5*	1-12	1-7	0-12.5	0-5.5	0-6	+	—	—

[1]Calculated to the nearest 0.5 ounce

[2]All changes marked with an asterisk were derived by subtracting weights taken in different half of the day.

Table 16. Gains of individual Mexican children in the group of constant gainers

Race and sex	Record year	Case No.	Birth month	Age, years	Monthly gains (Minimum in italics; maximum in blackface)								Total gains				Av. monthly gains[1]			Camparison of average rate of gain		
					Feb. Mar.	Mar. Apr.	Apr. May	Sept. Oct.	Oct. Nov.	Nov. Dec.	Dec. Jan.	Jan. Feb.	Feb. Jan. 12 mo.	Feb. Apr. 3 mo.	May Sept. 5 mo.	Oct. Jan. 4 mo.	Feb. Apr. Spring	May Sept. Summer	Oct. Jan. Fall	Spring minus fall	Summer minus spring	Summer minus fall
					lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.			
Mexican boys	'30	174	Nov.	12	0-13	*0-4*	0-14	0-5	2-10	1-4	1-4	4-2	15-13	1-15	4-10	9-4	0-10	0-15	2-5	—	+	—
	'29	176	Dec.	11	2-0	0-11	*0-1*		0-5	2-6	1-2	2-3	10-8	2-12	1-12	6-0	0-15	0-5.5	1-8	—	—	—
	'29	134	July	10	*0-1*	0-2	0-6		1-8	0-12	2-3	1-9*[2]	7-11	0-9	1-2*	6-0*	0-3	0-3.5	1-8	—	+	—
	'29	122	Jan.	13	1-5	1-4	0-11		1-9	0-13	*0-8*	2-6	9-4	3-4	0-12	5-4	1-1	0-2.5	1-5	—	—	—
	'29	164	July	10	0-1	0-5	*0-0*		2-5	*0-0*	0-6	1-4*	4-9	0-6	0-4	3-15*	0-2	0-0.8	1-0	—	—	—
	'30	18	Mar.	12	*0-3*	0-4	1-6	1-7	1-4	6-11	*0-3*	0-13*	9-15	1-13	4-3*	3-15	0-9.5	0-13	0-14	—	+	—
	'30	215	June	9	0-9	*0-4*	0-7*		0-10	0-15	0-11	1-2	5-8	1-4*	0-14	3-6	0-7	0-3	0-13.5	—	—	—
	'29	153	Mar.	12	3-9	1-10	2-3		3-9	*1-8*	1-15	1-14	22-2	7-6	5-14	8-14	2-7.5	1-3	2-3	+	—	—
	'29	43	Feb.	14	1-12	4-6	*0-0*		0-12	1-2	0-1	4-6*	21-6	6-2	8-15	6-5*	2-0.7	1-12.5	1-9.5	+	—	+
	'29	2	May	12	1-2	1-0	*0-10*		1-4	1-0	1-9	1-9	16-14	2-12	8-12	5-6	0-15	1-12	1-5.5	—	+	+
	'30	391	May	7	0-9	0-10	1-7		0-15	*0-8*	1-0	1-0	6-11	2-10	0-10	3-7	0-14	0-3	0-14	=	—	—
	'29	278	July	8	0-8	*0-3*	1-3		0-10	0-10	*0-3*	0-6*	6-1	1-14	2-6	1-13*	0-10	0-7.5	0-7	+	—	+
	'30	312	June	10	1-6	*0-0*	0-2	0-6	0-8	0-9	*0-0*	0-3	3-13	0-8	2-1	1-4	0-3	0-6.5	0-5	—	+	+
	'29	185	Mar.	10	1-10	1-3	0-7		0-3	*0-0*	0-2	0-12*	6-12	3-4	2-7	1-1*	1-1	0-8	0-4	+	—	+
Mexican girls	'30	18	May	14	*0-4*	0-11	1-1	1-6	3-6	1-14	3-9	2-2	16-15	2-0	4-0	10-15	0-10.5	0-13	2-12	—	+	—
	'30	175	Mar.	12	2-13	0-11	1-6	1-11	3-4	0-13	*0-5*	5-2*	22-12	4-14	8-6	9-8*	1-10	1-11	2-6	—	+	—
	'29	69	Sept.	10	1-0	*0-6*	1-8		1-10	2-7	2-1	1-9	14-6	2-14	3-13	7-11	0-15	0-12	1-15	—	—	—
	'29	331	June	11	3-9	0-7	0-2		2-3	*0-5*	1-11	1-15	11-4	4-2	1-0	6-2	1-6	0-3	1-8.5	—	—	—
	'29	137	Apr.	9	1-2	1-0	0-9		3-2	1-5	0-15	*0-0*	8-12	2-11	0-11	5-6	0-14	0-2	1-5.5	—	—	—
	'29	177	Aug.	12	1-3	0-7	0-9		0-15	*0-1*	1-14	2-2	12-11	2-3	5-8	5-0	0-12	1-1.5	1-4	—	+	—
	'30	84	Oct.	10	0-13	1-9	*0-0*	0-2	1-14	0-10	0-10	1-6	7-7	2-6	0-9	4-8	0-13	0-2	1-2	—	—	—
	'30	133	Mar.	13	0-5	1-4	*0-3*		1-9	0-5	0-9	1-0	6-6	1-12	1-3	3-7	0-9	0-4	0-14	—	—	—
	'30	109	Apr.	12	2-10	1-6	0-13	2-9	1-3	*0-2*	2-7	1-8*	18-5	4-13	8-4	5-4*	1-10	1-10.5	1-5	+	+	+
	'29	31	Jan.	9	2-3	0-13	0-12		1-1	1-8	2-4	*0-1*	12-10	3-12	4-0	4-14	1-4	0-13	1-3.5	+	—	+
	'29	39	Sept.	10	0-10	2-9	1-2		0-12	*0-1*	2-4	0-9	15-15	4-5	7-1	4-9	1-7	1-6.5	1-2	+	—	+
	'29	30	June	10	2-2	0-5	1-0		0-4	1-1	*0-3*	2-11	17-8	3-7	9-14	4-3	1-2	1-15.5	1-1	+	+	+
	'29	138	May	13	*0-1*	1-7	0-4		*0-1*	1-11	0-9	0-9	9-6	1-12	4-12*	2-14	0-9	0-15	0-11.5	—	+	+
	'30	168	June	11	1-0	1-3	0-1	0-7	0-14	0-10	*0-0*	0-13	8-6	2-4	3-13	2-5	0-12	0-12	0-9	+	=	+

[1]Calculated to the nearest 0.5 ounce

[2]All changes marked with an asterisk were derived by subtracting weights taken in different half of the day.

Table 17. Gains of individual negro children in the group of constant gainers

Race and sex	Record year	Case No.	Birth month	Age, years	Monthly gains (Minimum in italics; maximum in blackface)								Total gains				Av. monthly gains[1]			Camparison of average rate of gain		
					Feb. Mar.	Mar. Apr.	Apr. May	Sept. Oct.	Oct. Nov.	Nov. Dec.	Dec. Jan.	Jan. Feb.	Feb. Jan.	Feb. Mar.	Apr. Sept.	Oct. Jan.	Feb. Mar.	Apr. Sept.	Oct. Jan.			
					lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	lb.-oz.	12 mo. lb.-oz.	2 mo. lb.-oz.	6 mo. lb.-oz.	4 mo. lb.-oz.	Spring lb.-oz.	Summer lb.-oz.	Fall lb.-oz.	Spring minus fall	Summer minus spring	Summer minus fall
Negro boys	'30	36	Feb.	9	0-5	1-9	*0-0*	1-0	1-15	**3-6**	2-12	2-14	18-0	1-14	5-3	10-15	0-15	0-14	2-12	—	—	—
	'29	192	Mar.	12	1-0	*0-6*			3-13	0-5	1-3	**4-6**	18-2	1-6	**7-1**	9-11	0-11	1-3	2-7	—	+	—
	'29	153	Nov.	13	0-14	*0-0*			**3-3**	2-11	1-1	2-0	16-1	0-14	6-4	8-15	0-7	1-0.5	2-4	—	+	—
	'29	20	July	13	1-11	*0-2*			1-6	0-7	**3-0**	2-11	17-2	1-13	7-13	7-8	0-14.5	1-5	1-14	—	+	—
	'29	165	July	12	1-9	*0-9*			1-9	0-15	1-5	2-9	9-10	2-2	1-2	6-6	1-1	0-3	1-9.5	—	—	—
	'29	229	Jan.	12	1-5	*0-7*			1-12	0-9	2-7	1-5	15-7	1-12	7-10	6-1	**0-14**	1-4.5	1-8	—	+	—
	'29	21	Dec.	8	0-10	*0-4*			0-13	0-10	1-13	2-7	11-3	0-14	4-10	5-11	0-7	0-12.5	1-7	—	+	—
	'30	23	Sept.	10	0-7	*0-3*	**1-1**	0-11	0-4	0-15	0-7	0-7	5-7	0-10	2-12	2-1	0-5	0-7.5	0-8	—	+	—
	'30	57	July	14	**3-0**	0-11	*0-2*	0-8	1-11	2-11	2-3	0-4	20-3	3-11	9-11	6-13	1-13.5	1-10	1-11	+	—	—
	'29	85	Sept.	13	1-7	0-9			*0-3*	1-10	**2-9**	2-6	19-15	2-0	11-3	6-12	1-0	1-14	1-11	—	+	+
	'29	145	Aug.	14	**3-2**	1-5			1-9	*0-10*	2-14	0-13	23-13	4-7	13-7	5-15	2-3.5	2-4	1-8	+	+	+
	'29	45	June	9	*0-0*	**0-15**			**0-15**	0-2	0-1	0-15*[2]	7-1	0-15	4-1	2-1*	0-7.5	0-11	0-8	+	+	+
	'29	97	June	8	**1-13**	0-4			0-2	0-11	1-3	*0-0*	**7-2**	**2-1**	**3-1**	2-0	1-0.5	0-8	0-8	+	—	=
	'29	6	July	7	**0-9**	0-3			**0-9**	0-4	0-7	*0-1*	**4-14**	**0-12**	**2-13**	**1-5**	**0-6**	**0-7.5**	**0-5.5**	+	+	+
Negro girls	'29	90	Aug.	12	0-14	*0-4*			2-1	0-6	3-7	4-15	16-11	1-2	4-12	10-13	0-9	0-12.5	2-11.5	—	+	—
	'29	217	Mar.	12	2-7	1-12			2-4	**3-3**	2-9	*1-9*	24-6	4-3	10-10	9-9	2-1.5	1-12.5	2-6.5	—	—	—
	'29	138	Jan.	12	1-5	*0-5*			2-9	0-8	2-7	1-10	12-11	1-10	3-15	7-2	0-13	0-10.5	1-12.5	—	—	—
	'29	242	June	12	0-4	0-9			**2-14**	2-5	*0-3*	0-10	9-4	**0-13**	2-7	6-0	0-6.5	0-6.5	1-8	—	=	—
	'29	65	Apr.	12	2-2	*0-10*			2-9	0-15	0-13	1-6	12-9	2-12	4-2	5-11	1-6	0-11	1-7	—	—	—
	'29	139	July	7	0-8	0-7			**2-4**	1-6	*0-4*	0-15*	6-4	0-15	0-8*	4-13*	0-7.5	0-1	1-3	—	—	—
	'30	123	Dec.	11	*0-0*	1-5	*0-0*	0-10	1-4	1-2	1-12	0-5	10-0	1-5	4-4	4-7	0-10.5	0-11.5	1-1.5	—	+	—
	'29	123	Dec.	10	*0-3*	0-12			1-3	1-1	0-12	**1-6**	6-10	0-15	1-5	4-6	0-7.5	0-3.5	1-1.5	—	—	—
	'30	220	Jan.	9	1-6	0-4	*0-1*	**0-7**	**2-13**	0-8	*0-1*	0-14	10-6	1-10	4-8	4-4	0-13	0-12	1-1	—	—	—
	'30	212	Feb.	9	0-15	0-8	0-3	0-9	*0-1*	1-6	**1-11**	0-4	6-12	1-7	1-15	3-6	0-11.5	0-5	0-13.5	—	—	—
	'29	241	Feb.	10	0-10	0-13			0-13	*0-9*	1-9	**1-15**	10-3	1-7	3-14	4-14	0-11.5	0-10.5	0-13	—	—	—
	'29	215	Apr.	8	0-11	*0-3*			0-6	0-8	0-12	**1-4**	6-1	0-14	2-5	2-14	0-7	0-6	0-11.5	—	—	—
	'29	101	July	10	0-10	0-15			*0-9*	1-10	**3-14**	3-3	31-5	1-9	20-8	9-4	0-12.5	3-6.5	2-5	—	+	+
	'29	193	July	11	*0-0*	**3-10**			**0-13**	0-15	0-12	0-7*	16-15	3-10	10-6	2-15*	**1-13**	1-11.5	0-12	+	—	+

[1]Calculated to the nearest 0.5 ounce

[2]All changes marked with an asterisk were derived by subtracting weights taken in different half of the day.

Table 18. Comparison of seasonal average rates of gain of the constant gainers (group X)

Race	Sex	Total No.	No. of cases in seasons compared									
			Spring greater than fall	Spring less than fall	Spring equal fall	Summer greater than fall	Summer less than fall	Summer equal fall	Summer greater than spring	Summer less than spring	Summer equal spring	Fall greater than both spring and summer
White	Boys	20	7	12	1	0	20	0	3	16	1	12
	Girls	22	8	14	0	1	21	0	1	21	0	14
	Both	42	15	26	1	1	41	0	4	37	1	26
Mexican	Boys	14	4	9	1	5	9	0	5	9	0	7
	Girls	14	5	9	0	5	9	0	6	7	1	8
	Both	28	9	18	1	10	18	0	11	16	1	15
Negro	Boys	14	4	10	0	4	9	1	10	4	0	8
	Girls	14	1	13	0	2	12	0	3	10	1	12
	Both	28	5	23	0	6	21	1	13	14	1	20

ships of the average monthly gains for each child are summarized in Table 18. They form the basis for arranging the curves of growth, one for each individual record, in Figures 11, 12, 13, 14, 15, and 16. Those records in which the average monthly gain in the fall months exceeded that of both spring and summer months occupy the lower portion of the figure; those in which either spring or summer, or both, exceeded

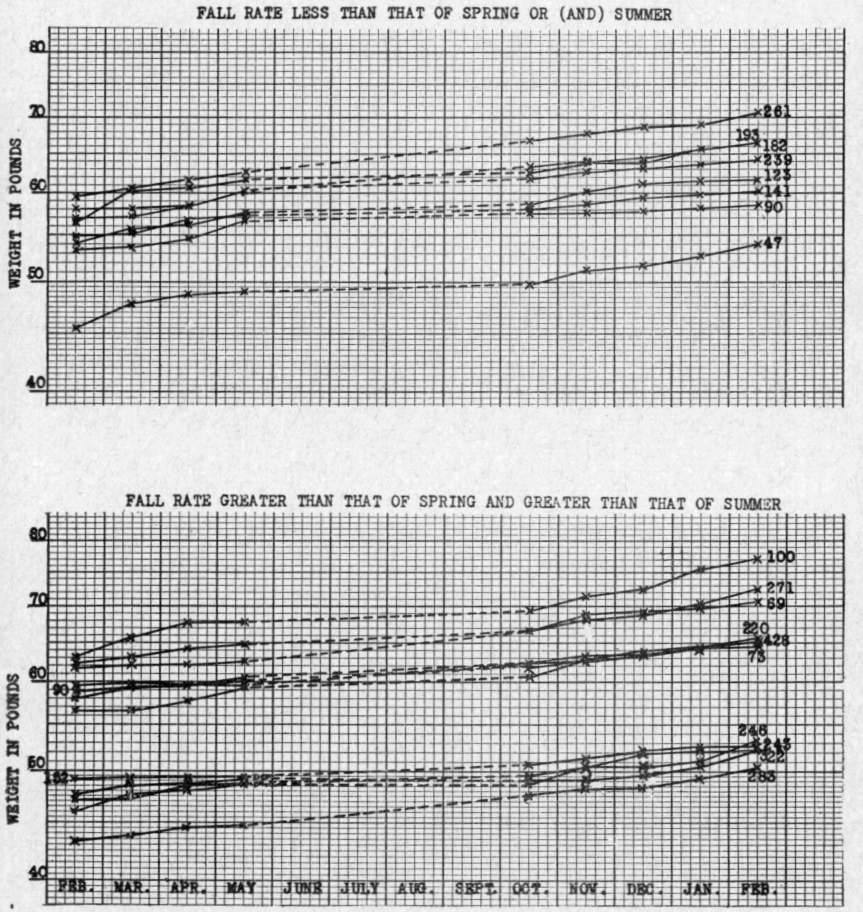

Fig. 11. Curves of growth, during 12 months, of individual white boys who were constant gainers. Case number at end of curve.

the fall rate are in the upper portion of the figure. According to the records in Table 18, a little more than ½ of both the white and Mexican children, and 2/3 of the negro, grew faster in the fall than in either spring or summer. About 1/3 of the white and Mexican children and nearly ¼ of the negro children had greater gains in spring than in fall.

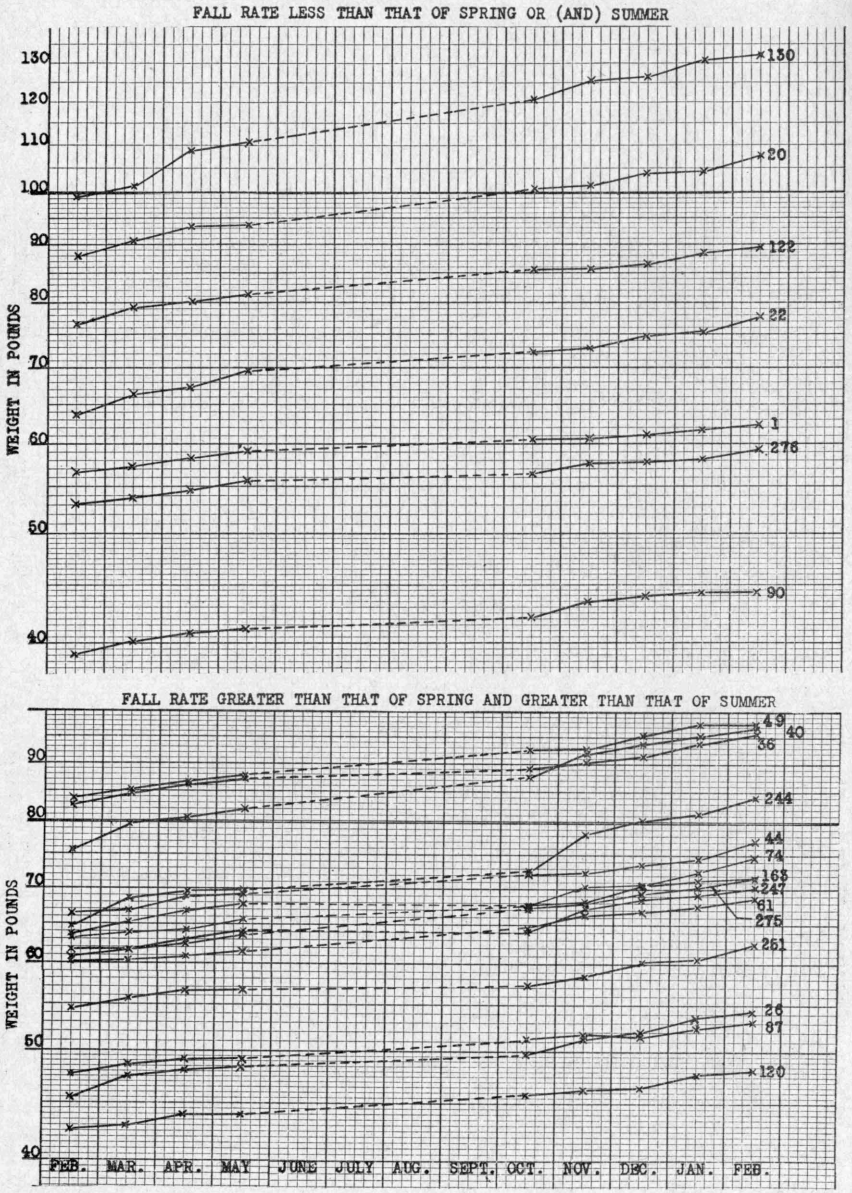

Fig. 12. Curves of growth, during 12 months, of individual white girls who were constant gainers. Case number at end of curve.

One white child, 10 Mexican children, and 6 negro children (about 1/3 and ¼ respectively of the two latter groups) made greater gain in summer than in fall. Summer rates exceeded spring rates more often among negro and Mexican children (in almost ½ of the cases) than

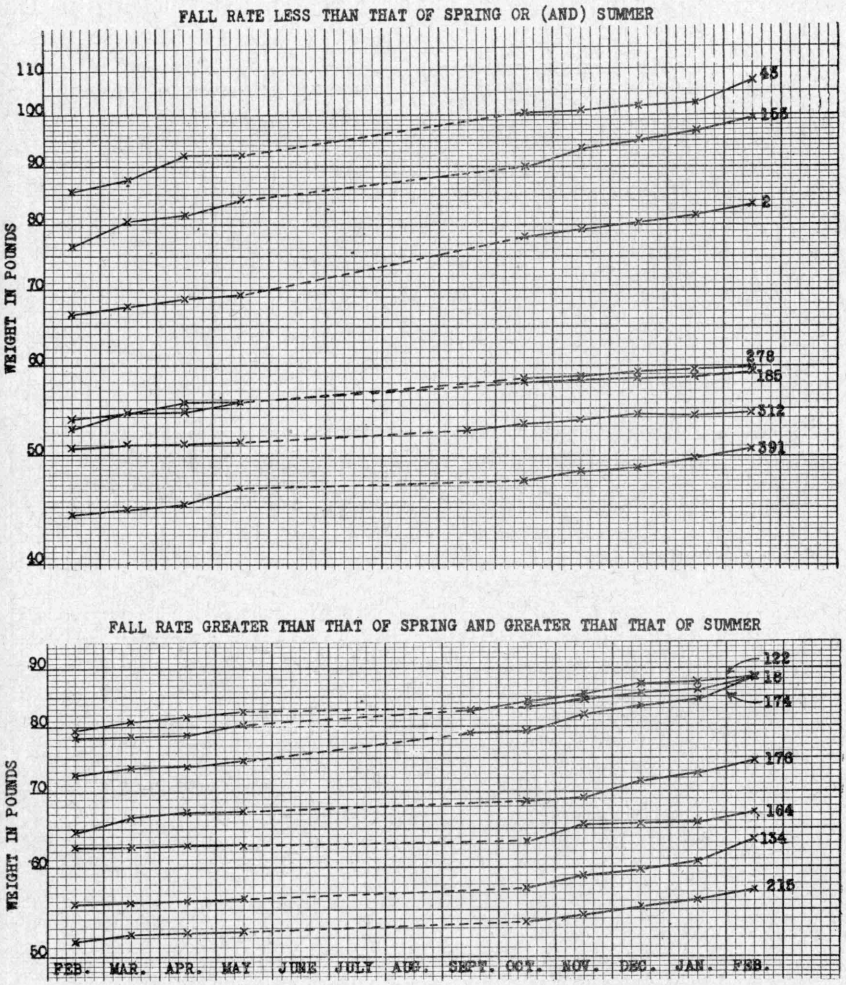

Fig. 13. Curves of growth, during 12 months, of individual Mexican boys who were constant gainers. Case number at end of curve.

among white children, who had only 4 such cases. It is clear from the course of growth disclosed by these individual records that while fall is an outstanding season for good gains, neither spring nor summer is incompatible with excellent growth, especially among Mexican and negro children.

The weights of these 98 children at the first weighing in the record year ranged from 39 to 105 pounds. Direct comparison of the monthly percentage rate of gain in weight of these individuals is made possible by the use of a semi-logarithmic scale to plot the individual curves of growth (8). Regardless of the initial weight, parallel lines represent

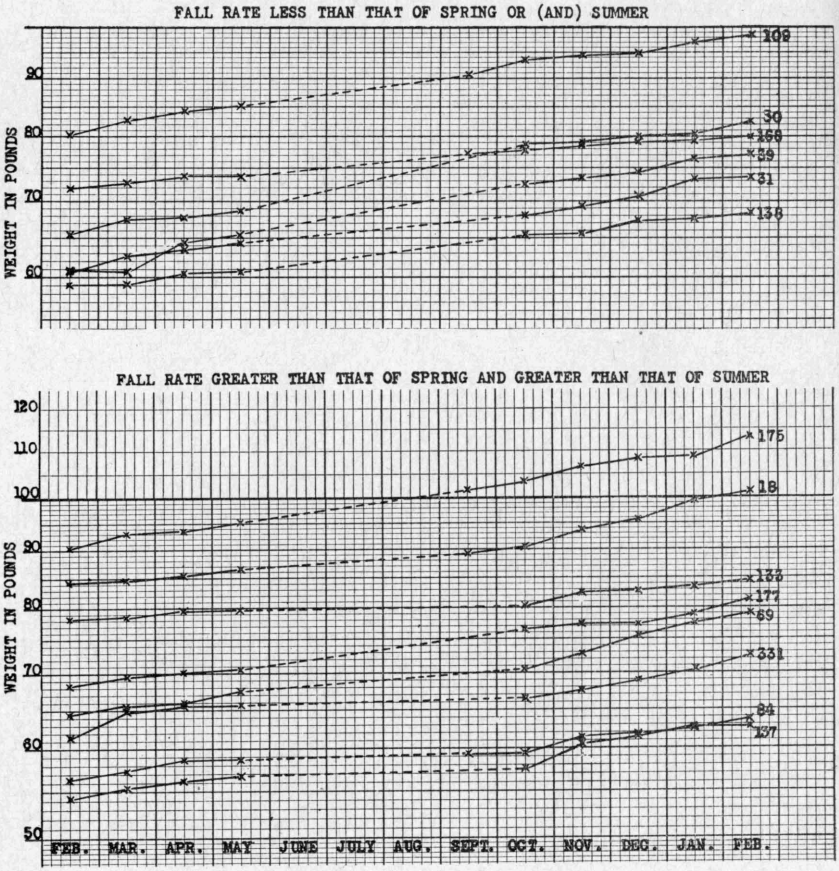

Fig. 14. Curves of growth, during 12 months, of individual Mexican girls who were constant gainers. Case number at end of curve.

the same percentage rate of growth, and in all cases the steeper the line, the faster the rate. The dotted line connecting the last spring month weighing with that of the first fall month (Figures 11, 12, 13, 14, 15, and 16) represents the average rate of growth through the summer, without conveying any information as to change in weight from one month to the next in summer. Whether any child lost weight in one or more

summer months is not known since no weights were taken in summer; but any summer time losses were compensated by gains before the first fall weighing. The most conspicuous feature of the individual monthly

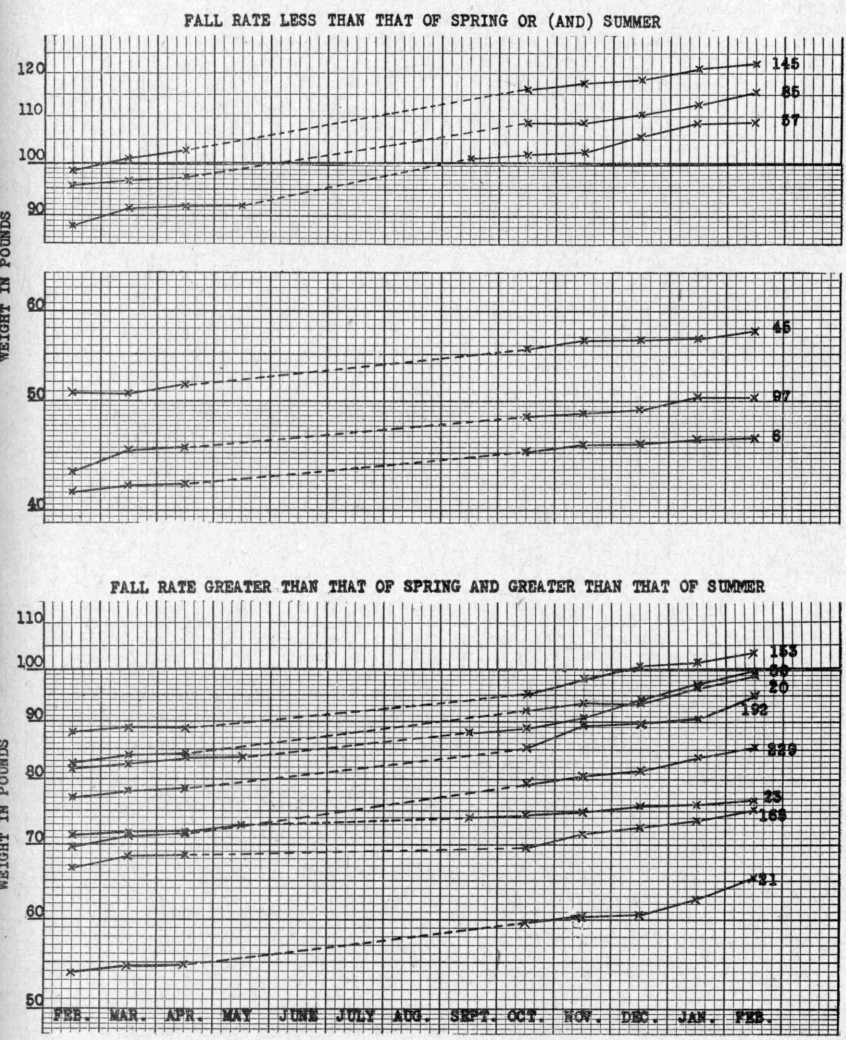

Fig. 15. Curves of growth, during 12 months, of individual negro boys who were constant gainers. Case number at end of curve.

gains as brought out in these graphs is the variation in the amount of any one child's gain from month to month and the infrequency of approximately uniform gain for even two consecutive months. Among the 98 records there are only 5 in which the gains of three consecutive months

were within 3 ounces or less of each other; in 43 of the 98 records the gains of no more than two consecutive months were within 3 ounces of each other. The months in which these individual children made their

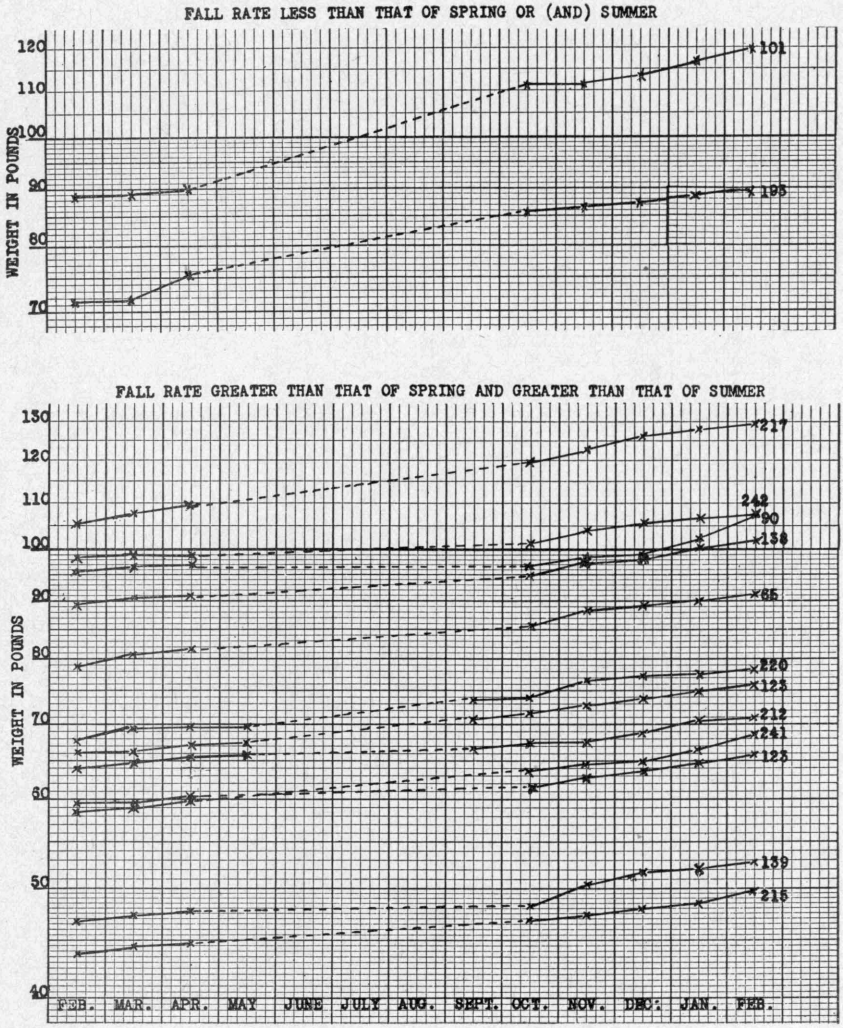

Fig. 16. Curves of growth, during 12 months, of individual negro girls who were constant gainers. Case number at end of curve.

maximum and also their minimum gains are recorded in Table 19. September is the only month of the nine in the schedule of weighing in which neither maximum nor minimum weight appears; in each other month both

Table 19. Months of maximum and minimum gain of children who were constant gainers (group X)

Race	Sex	Total No. of cases	No. of children for whom the most gain (+ column) and least gain (— column) occurred in the month shown																	
			Feb.		Mar.		Apr.		Sept.		Oct.		Nov.		Dec.		Jan.			
			+	—	+	—	+	—	+	—	+	—	+	—	+	—	+	—		
White	Boys	20	3	2*[1]	1	6*	3	6*			3	3*	2	4*	3	1	5	4*		
	Girls	22	4*	3	2	2	0	6*			6	3	2	3*	4	3	5*	3		
	Both	42	7	5	3	8	3	12			9	6	4	7	7	4	10	7		
Mexican	Boys	14	3*	2*	1	4*	2	4*			2*	0	2	4*	2*	4*	4*	0		
	Girls	14	2	1*	2	2	0	2			4	1*	1	4	3	3	2	2		
	Both	28	5	3	3	6	2	6			6	1	3	8	5	7	6	2		
Negro	Boys	14	4*	1	1*	7	1	2			3*	1	1	1	3	0	3	2		
	Girls	14	0	3*	1	4	0	2*			5	2	1	1	3	3*	4	1		
	Both	28	4	4	2	11	1	4			8	3	2	2	6	3	7	3		

[1]The gain in the months marked with * is duplicated in another month also marked *.

maximum and minimum gains were made, and frequently identical gains were made by the same child in two different months. Approximately 1/3 of the maximum gains for the white and Mexican children and ¼ of them for the negro children were in the three spring months, February, March, and April. Among fall months, maximum gains were made in October, December, and January with nearly equal frequency, with November showing fewer maximum gains. The minimum gains were about equally divided between the three spring months and the four fall months. April for white children, and March for negro children, stand out as months of minimum gains, with other spring and the fall months fairly comparable in number of minimum gains. Both March and April show more minimum gains than February among Mexican children, but November and December have still greater numbers of the Mexicans' minimum gains.

While approximately two-thirds of these individual records lend confirmation to the trends in seasonal variation in growth indicated in the foregoing analyses of data for groups A, A+B, and A+C, there are plenty of departures in the individual records from the group trends to emphasize the necessity or regarding each child individually in following his course of growth. It is apparent from the findings upon the individual records in this study that if a natural biological phenomenon tends to express itself in rhythmic seasonal variation, the rhythm is not uniform for all individuals of any of the three races living in the same city and observed at the same time, or else this natural tendency is over-balanced at one season or another by one or more other factors influencing the course of growth. An inquiry should be made into the probable reason for a child's failure to gain in any season of the year. How much irregularity in the monthly rate of increase in weight is within the zone of normal growth must be determined by further study.

Diet

The analyses using diet records were referred in particular to October and April since these were outstanding and contrasting months with respect to the gains made in them by the various groups. The use for each child of but one diet record of date as near as possible to the weighing intervals under consideration seemed reasonable. In another study (26) as well as in this, striking similarity has been found in the kinds of foods eaten at the different seasons of the year by school children of the three races. The diet scores ranged from 63 to 66 (on a basis of 100) for January, February, March, and April 1929 on the diet records collected from all the white children in this study that year. The records secured from a sufficiently large number of pupils in any one month may be accepted as a fairly satisfactory indication of the customary type of diet.

The number of diet records available for this analysis were in May and October 1929 and May and October 1930 for white children, 136, 124, 117, 41; for Mexican, 90, 90, 65, 35; for negro, 186, 191, 124, 44. The diet

records of each month used were divided into two groups according to whether the children for whom they were secured gained or lost weight in the corresponding month. Only nine groups of gainers and losers could be formed for each race owing to the small number of children in October 1930, among whom there were but 4, 3, and 7 white, Mexican, and negro children, respectively, who lost weight during this month. The analysis made of the diet records was similar to that employed in a previous study (26) in which the same type of record was kept. The prominence in the diet of milk, butter, fruits, vegetables, protein-rich foods (other than milk) and sweet foods, was judged by the frequency with which they were recorded in each child's records. Such procedure is regarded as indicating with a fairly high degree of reliability the **kind** of foods constituting the diet, but as giving only suggestive rather than definite information as to the **amount** of the several foods consumed. However, whatever error is involved in the diet record analysis applies alike to those of the children who gained and those who lost weight.

Only one of the nine groups of gainers and losers (the Mexican children in May 1929) gave evidence that the losers had a poorer diet than the gainers, and this in reference to but one food; 71 per cent of the losers had ½ cup or less of milk, while of the gainers only 54 per cent had such a small amount. Otherwise, gainers and losers for each set of diet records appeared to be remarkably similar with respect to the character of their diet. The May and October diets of the gainers and of the losers were also compared. Noteworthy differences which suggest a positive relation of type of diet to gaining were observed only with some of the food classes for the Mexican children who were gainers. The percentages of the gaining group having 1 pint or more of milk in the Octobers were 39 and 47 compared with 20 and 30 in May of the same year; in October 1929, 35 per cent had more than ½ serving of butter per day, while in May there were only 20 per cent with this much; in October 1930, 69 per cent of the gainers had 3 or more servings of cereal foods of all kinds, while only 33 per cent in May had the same amount.

The data of this study therefore appear to give no convincing evidence that the character of the diet was an important factor in effecting the relatively large gains in October and relatively small gains in April. The fact that information as to the **amount** of food eaten is lacking may be in part responsible for the fact that no positive relationship was found. Yet it is also possible that some other factor (or factors) may have overbalanced the effect of diet.

Minor Illnesses

Mention has been made of the elimination from the children's records used for this report of all those in which weight for any child was less than the preceding weight, if the child reported a major illness within the interval between weighings. That there was no necessity to include "colds" among the major illnesses can be seen readily by the figures in Table 20

Table 20. Health record for a representative spring and a fall month o f the children whose weighing records were used for this report.

Race	Year and month of weight change	Illness since previous weighing as reported by the child																	
		Gainers									Losers								
		No. cases	None		Cold		Other		No record		No. cases	None		Cold		Other		No record	
			No.	%	No.	%	No.	%	No.	%		No.	%	No.	%	No.	%	No.	%
White	1929 Apr.	115	83	72.2	25	21.7	6	5.2	1	0.9	59	32	54.2	17	28.8	10	16.9		
	1929 Oct.	152	78	51.3	58	38.2	16	10.5			27	15	55.6	9	33.3	3	11.1		
	1930 Apr.	86	57	66.3	18	20.9	11	12.8			**77**	**55**	**71.4**	**17**	**22.1**	**5**	**6.5**		
	1930 Oct.	196	117	59.7	68	34.7	11	5.6			**31**	**15**	**48.4**	**12**	**38.7**	**4**	**12.9**		
Mexican	1929 Apr.	89	79	88.8	4	4.5	6	6.7			76	66	86.8	2	2.6	8	10.5		
	1929 Oct.	145	108	74.5	20	13.8	17	11.7			28	21	75.0	4	14.3	3	10.7		
	1930 Apr.	105	90	85.7	4	3.8	11	10.5			59	42	71.2	5	8.5	11	18.6	1	1.7
	1930 Oct.	152	108	71.1	28	18.4	16	10.5			18	11	61.1	5	27.8	2	11.1		
Negro	1929 Apr.	119	96	80.7	9	7.6	14	11.8			84	70	83.3	7	8.3	6	7.1	1	1.2
	1929 Oct.	153	86	56.2	49	32.0	18	11.8			52	33	63.5	15	28.8	4	7.7		
	1930 Apr.	126	100	79.4	15	11.9	11	8.7			74	59	79.7	6	8.1	9	12.2		
	1930 Oct.	159	106	66.7	42	26.4	11	6.9			41	32	78.0	5	12.2	4	9.8		

which show the health record secured from the children for the two months used in this analysis. For the most part, quite similar percentages of the gainers and losers within each race had suffered colds in the same month. Colds were reported by from 21 per cent to 39 per cent of the white children, by from 3 per cent to 29 per cent of the Mexican, and by from 8 per cent to 32 per cent of the negro. The only noteworthy differences are with the negroes, in October 1930, when more gainers than losers had colds, and with the Mexicans in October 1930, when more losers than gainers had colds. The percentage of gainers and losers in each race reporting "no illness" were likewise fairly similar in a given month, ranging from 48 per cent to 72 per cent for white, from 61 per cent to 88 per cent for Mexican, and from 56 per cent to 83 per cent for negro children. Ailments other than colds as reported by the children included tonsilitis, sore throat, earache, ear infection, toothache, headache, stomachache, "sores" (usually impetigo or scabies), sore eyes, rash, "fever," pyelitis, measles, and mumps. It must be remembered that such diseases as pyelitis, measles, and mumps among these other ailments in these records were never associated with a loss shown on the child's record; any loss accompanying them had been compensated by the time the child was weighed at the time he reported the illness. Some 5 to 10 per cent in each race gave report of one or another of these other illnesses each month.

In every case among both gainers and losers the percentage of children who had had colds during the month was less in April than in October of the same year. This lesser prevalence of colds in April associated with consistently poor gains, and greater prevalence of colds in October along with uniformly excellent gains is not concordant with the suggestion of Emerson (7) that lesser gains found frequently in spring are in large part a reflection of the influence of respiratory infections. This study appears to afford no evidence that colds or other minor ailments have a determining influence upon the seasonal variations in growth.

Climatic Conditions

The meteorological monthly and yearly summaries for 1929, 1930, and 1931 secured from the U. S. Weather Bureau in San Antonio have been inspected to see if climatic conditions might bear an obvious relation to seasonal variations in weight gains. The climatic conditions during the time included in the period of data collection and considered in this connection are recorded in Table 21. The deviations from normal of monthly mean temperature, and of rainfall, together with the maximum, minimum, and daily range of temperature for each month, range of mean atmospheric pressure, relative humidity, and percentage of sunshine, are of such an order as not to mark any one year or season in the 2½-year period as being exceptional. The two months, April and October, that command particular attention with respect to gains in weight, hold a fairly middle position among the other months of the year, neither being at the extremes of climatic conditions. It is especially interesting that these two months

Table 21. Data from records of U. S. Weather Bureau, San Antonio, Texas

Year	Month	Temperature in degrees Fahrenheit									Mean atmospheric pressure, inches	Precipitation, inches			Mean relative humidity percentage			Sunshine mean, per cent
		Max.	Min.	Daily range		Mean			Normal	Av. daily excess (+) or deficiency (—) of this month vs. normal		Total	Normal	Excess (+) or deficiency (—) of this month vs. normal	7 a. m.	Noon	7 p. m.	
				Greatest	Least	Max.	Min.	Mean										
	Jan.	83	28	36	7	63.9	43.7	53.8	52.3	+1.5	30.06	2.21	1.46	+0.75	81	59	59	51
	Feb.	78	22	40	5	60.9	39.0	50.0	55.4	—5.4	30.03	0.16	1.65	—1.49	82	61	55	50
	Mar.	94	38	39	5	76.0	55.7	65.8	62.8	+3.0	29.91	3.12	1.84	+1.28	81	54	49	59
	Apr.	94	56	29	11	81.9	63.6	72.8	69.1	+3.7	29.89	2.37	3.19	—0.82	83	57	60	50
	May	99	48	44	10	84.9	64.5	74.7	75.1	—0.4	29.93	7.73	3.20	+4.53	85	56	60	59
	June	96	70	26	14	91.1	72.3	81.7	81.0	+0.7	29.90	2.19	2.46	—0.27	87	54	53	78
1929	July	95	68	22	10	90.6	73.2	81.9	83.8	—1.9	29.98	2.58	2.17	+0.41	91	57	60	69
	Aug.	99	20	25	17	95.8	74.4	85.1	83.5	+1.6	29.95	0.01	2.42	—2.41	83	43	40	85
	Sept.	97	61	26	13	90.8	69.8	80.3	79.0	+1.3	29.92	2.02	3.05	—1.03	84	47	47	79
	Oct.	97	47	31	7	82.4	61.5	72.0	70.5	+1.5	30.00	1.60	2.23	—0.63	83	48	51	68
	Nov.	84	31	35	4	64.6	45.3	55.0	60.3	—5.3	30.12	3.17	1.90	+1.27	74	57	62	44
	Dec.	80	21	33	8	64.9	44.3	54.6	53.7	+0.9	30.18	2.08	1.61	+0.47	77	54	58	56
Annual						79.0	58.9	69.0				29.24	27.18		83	54	54	62
	Jan.	73	11	29	5	52.3	34.2	43.2	52.3	—9.1	30.20	1.25	1.46	—0.21	80	68	68	33
	Feb.	86	37	35	7	71.7	51.5	61.6	55.4	+6.2	30.03	0.94	1.65	—0.71	82	59	54	54
	Mar.	91	33	32	3	68.8	48.9	58.8	62.8	—4.0	30.00	1.76	1.84	—0.08	74	52	50	45
	Apr.	93	50	34	9	62.9	61.5	72.2	69.1	+3.1	29.96	2.20	3.19	—0.99	81	49	52	49
	May	91	58	28	5	82.7	67.2	75.0	75.1	—0.1	29.92	0.89	3.20	—2.31	82	59	63	36
	June	98	60	25	5	88.4	70.8	79.6	81.0	—1.4	29.93	4.03	2.46	+1.57	81	56	55	51
1930	July	99	69	26	14	95.0	73.5	84.2	83.8	+0.4	29.99	1.99	2.17	—0.18	82	48	46	71
	Aug.	103	70	28	16	97.7	74.0	85.8	83.5	+2.3	29.95	0.41	2.42	—2.01	86	45	40	73
	Sept.	100	58	28	8	91.6	69.8	80.7	79.0	+1.7	29.91	1.74	3.05	—1.31	82	50	46	65
	Oct.	90	47	26	7	78.0	61.5	69.8	70.5	—0.7	29.99	4.01	2.23	+1.78	81	62	63	40
	Nov.	82	38	26	5	67.4	52.0	59.7	60.3	—0.6	30.11	2.69	1.90	+0.79	73	56	62	33
	Dec.	73	29	27	9	59.6	42.3	51.0	53.7	—2.7	30.16	0.88	1.61	—0.73	78	59	58	62
Annual						78.0	58.9	68.5				22.79	27.18		80	56	55	51
	Jan.	70	30	26	6	60.0	45.1	52.6	52.3	+0.3	30.14	5.86	1.46	+4.40	79	63	66	50
	Feb.	75	40	28	6	65.8	49.0	57.4	55.4	+2.0	30.02	2.68	1.65	+1.03	84	68	62	59
1931	Mar.	84	32	29	12	69.3	46.6	58.0	62.8	—4.8	30.01	2.06	1.84	+0.22	74	47	43	78
	Apr.	88	42	36	5	73.9	54.5	64.2	69.1	—4.9	30.02	2.28	3.19	—0.91	83	58	51	58
	May	90	52	30	9	82.0	63.0	72.5	75.1	—2.6	29.93	1.36	3.20	—1.84	82	54	50	70
Annual						78.9	60.0	69.5				25.00	27.18		84	57	54	67

which show the most marked differences in the average gains in the several groups of children should, with the exception of two adjacent months in each year, have the least difference of any two months of the year in their mean temperature. In 1929 April and October mean temperatures differed by 0.8° F., June and July by 0.2° F.; in 1930 the April mean temperature was 2.4° F. higher than the mean temperature of October, and July and August differed by 1.6° F. The maximum temperature of April was 3° F. lower than that of October in 1929, and 3° F. higher in 1930. The minimum temperatures of April and October differed less than the minimum temperature of either month differed from that of the month preceding or following. The highest and lowest daily temperature range in October and in April are not unusual in comparison with the other months. There was an annual average of 62 per cent of sunshine in 1929, which was a little higher than that in 1930, with an average of 51 per cent. The relative percentages of sunshine in April and October were reversed in the two years, April having had 50 per cent and October 68 per cent in 1929, while in 1930 April had 49 per cent and October 40 per cent.

September, which in its mean temperature more nearly resembled summer months than fall months, was found to be almost as good for gaining as October. Both March and April had distinctly higher mean temperatures than the four coldest months, November, December, January, and February, but they were also distinctly cooler than the summer months; yet in the several groups of the three races otherwise unclassified (Table 3), April consistently and March usually had a smaller proportion of the yearly gain than the average monthly gain of the five summer months. If high temperatures were incompatible with rapid gains, and the effect immediately apparent, September would scarcely be expected to have taken a place beside October in good gains, and March and April with intermediate temperatures would scarcely have occupied the lowest position in the scale of average gains. The intermediate and similar temperatures for April and October are associated with the average monthly gains showing the greatest differences.

It might be possible that there is a cumulative effect of the summer conditions really favorable to growth that finds expression only near the end of summer, and similarly that less favorable conditions in fall and winter months find expression in the lower net gains of March and April. Another possibility is that the varying period of daylight may have had an influence upon the course of growth through the year. In some animals, for example the Angora goat and the Shropshire sheep, the estrus cycles occur only in the season of short days. On the basis of the newer knowledge of the internal secretions of the anterior pituitary, it is almost certain that the sex cycles are controlled by these internal secretions. There is some evidence that the activity of the pituitary is correlated with the season. As a growth-promoting hormone is also elaborated in the anterior lobe of the pituitary of mammals, it seems reasonable that a possibly increased production of the growth hormone might effect a

greater stimulus to growth in the fall months when days are growing shorter, than in the spring and summer with lengthening days. April and October each follow the month in which equal days and nights occur, but differ in that April is in the period of lengthening days while October is in that of shortening days. The relatively smaller average monthly percentage of the yearly gain made, especially by white children, in the summer months when days are longer, is concordant with the finding of Nylin (15) that artificial irradiation retarded weight increase. On the other hand, some groups in this Texas study had gains in March, February, and November no greater than the average monthly gain in summer.

In view of the monthly weight changes made by individual children in this study, the suggestion that cumulative seasonal effect or length of day influences seasonal variation in weight increments seems hardly as feasible as that some other factors than climatic conditions per se are chiefly responsible for the contrast in average net gains of April and October. Further, it must be recalled that among the children whose records of growth through the year were examined individually nearly ½ of the Mexicans and negroes and a few of the white children made good gains during the summer. No explanation of seasonal variations in average weight gains was found in the climatic conditions.

Other Possible Factors

Among the factors which may have a share in determining seasonal variations but upon which this study contains no data are the amount of exercise; the amount of daily rest, particularly hours in bed; the quantity of food eaten; and the nervous tension from home life or school program under which the child may live. The speculation is made that with the opening of schools in the fall the majority of children return to a more regular regime of living with perhaps more rest and more regular meals than they had in the summer. Such a suggestion implies that conditions of rest and exercise in relation to food intake were better attuned to the processes of growth for Mexicans and negroes in the summer than for white children since the latter had a poorer growth in summer than did the other two races. Another speculation offered is that the strain of the special events (final examinations, plays, and pageants) that usually come at the last of the school year, in addition to regular school work may so interfere with food intake and rest that rate of growth is retarded. Definite information along such lines might help to explain both the trend of seasonal variation in groups of children, and the variations in seasonal differences in growth rates of individual healthy children.

GROWTH IN HEIGHT

Selection of Records

The schedule of measuring periods (Table 1) included five in which standing and sitting heights were measured, the intervals of growth in

height affording a series of fall-to-spring and spring-to-fall increments. The approximate length of the four intervals between measuring periods from the beginning to the end of the time of data collection was for white children 8⅓ months, 5 months, 7 months, and 7 months; for Mexican children 8½, 5, 7, and 6 months; and for negro children 9⅓, 5, 7, and 6 months. Ideally, all height measurements of a given child should have been made at the same time of day. This, however, was not practicable in all cases owing (1) to the promotion of the child through the grades, which sometimes made it necessary to change the measuring time for a class to fit this work into the regular school schedule, and (2) to the necessity of measuring height and weight in the same weighing period. In the interest of accuracy with the available data, the records selected for this analysis were limited to those of children measured in the same quarter of the school day. On this basis, two groups of children were formed for each race (Table 2). In group A were all children (72 white, 35 Mexican, 158 negro) who had been measured at the same time of day in all five measuring periods. Group B consisted of the largest possible number of children (white 176, Mexican 118, and negro 288) that would afford a comparison of growth made in two periods, fall-to-spring and spring-to-fall consecutively, and also permitted direct comparison of the three races because the growing interval was the same, October 1929 to March 1930, 5 months, and March 1930 to October 1930, 7 months.

Seasonal Variation by Race and Sex

The average gain per child for both standing and sitting height for the fall-to-spring and spring-to-fall intervals was determined by dividing the total gain of the group by the number in it. The average gain per child per month was then derived by dividing the average gain of each interval by the number of months in the interval. Thus comparable average monthly rates for any two adjacent intervals were secured. So as to compare seasonal variation in height with that in weight, the average gain in pounds per child per month for the same periods was also similarly calculated. These data for the sexes together and separately in each race are given in Tables 22 and 23 for groups A and B respectively.

Group A, Having Gain of Two Years

With the smaller group of children (group A) followed over the longer period of time, three consecutive spring-to-fall : fall-to-spring intervals are available for comparison with each other. In Table 22 are recorded the average gains in standing height, in sitting height, and in weight for these four consecutive intervals of time. Differences between seasons in average monthly rates of growth in standing height are seen to be quite small and not consistent among the three races, nor within the Mexican and negro races. For white children, spring-to-fall rates were less than fall-to-spring rates; Mexicans gained less in two spring-to-fall intervals and more in the third than in the adjacent fall-to-spring interval; negroes had greater gains in two spring-to-fall than in fall-to-spring

Table 22. Growth as shown by gains in standing height, sitting height, and weight over four consecutive intervals by the boys and the girls of the three race groups

Race	Sex	No. of cases	Average gain per child per month											
			Standing height, inches				Sitting height, inches				Weight, pounds			
			Feb. '29-Oct. '29	Oct. '29-Mar. '30	Mar. '30-Oct. '30	Oct. '30-May '31	Feb. '29-Oct. '29	Oct. '29-Mar. '30	Mar. '30-Oct. '30	Oct. '30-May '31	Feb. '29-Oct. '29	Oct. '29-Mar. '30	Mar. '30-Oct. '30	Oct. '30-May '31
			8-9 mo.[1]	5 mo.	7 mo.	6-7 mo.[2]	8-9 mo.[1]	5 mo.	7 mo.	6-7 mo.[2]	8-9 mo.[1]	5 mo.	7 mo.	6-7 mo.[2]
White	Boys	44	0.176	0.178	0.160	0.179	0.066	0.076	0.074	0.073	0.43	0.66	0.47	0.71
	Girls	28	0.188	0.192	0.193	0.200	0.076	0.080	0.107	0.087	0.52	0.81	0.53	0.88
	Both	72	0.162	0.184	0.173	0.187	0.070	0.077	0.087	0.079	0.46	0.72	0.50	0.77
Mexican	Boys	15	0.147	0.168	0.193	0.213	0.066	0.072	0.061	0.092	0.49	0.61	0.62	0.97
	Girls	20	0.179	0.174	0.201	0.190	0.080	0.096	0.087	0.088	0.53	0.77	0.70	0.89
	Both	35	0.166	0.170	0.198	0.200	0.074	0.085	0.076	0.090	0.51	0.70	0.67	0.93
Negro	Boys	70	0.184	0.188	0.187	0.190	0.078	0.108	0.070	0.080	0.63	0.75	0.66	0.77
	Girls	88	0.179	0.160	0.157	0.130	0.085	0.112	0.064	0.073	0.63	0.77	0.61	0.73
	Both	158	0.181	0.172	0.171	0.156	0.082	0.110	0.067	0.076	0.63	0.76	0.63	0.75

[1]White children, 8-1/3 mo.; Mexican, 8½ ; negro, 9-1/3.
[2]White children, 7 mo.; Mexican and negro, 6 mo.

intervals and equal gains in the third set of adjacent seasonal intervals.

Seasonal differences in average monthly gains per child in sitting height are in the same direction among Mexican and negro children, spring-to-fall rates being less than fall-to-spring rates in all six comparisons. For white children the spring-to-fall rate is less once, but more twice, than in the adjacent fall-to-spring interval. Within each race the seasonal differences in average sitting height gains are usually, but not always, in the same direction as are those for standing height gains.

Boys and girls in the three races had seasonal differences in standing and sitting height gains that usually agreed with those of the corresponding total race group, but some irregularities are exhibited. These small differences in height gains, variable among the races and within them, show no tendency to a definite seasonal variation of growth in height.

In contrast to the variable seasonal differences in height gains, the changes in weight over the same intervals were consistently more in fall-to-spring than in spring-to-fall among all race and sex groups.

Group B, Having Gain of One Year

The yearly gain in height was practically the same for the three races—standing height 2.1 inches, sitting height approximately 1.0 inch (Table 23). In each race, differences in average monthly increases in height during the 2 intervals were exceedingly small, unworthy, no doubt, of serious consideration, but it is interesting that without exception fall-to-spring average monthly gains tended to be less than spring-to-fall gains. Seasonal differences in gains in weight over the same periods are probably large enough to represent a real difference in growth rate, with fall-to-spring increments exceeding those of spring-to-fall, just opposite in direction to seasonal differences in rates of growth in height.

The differences in seasonal rates of increase in standing height for the sexes separately in group B are in the same direction as for both sexes of Mexican and negro children, but the white boys' rate in fall-to-spring very slightly exceeded that of their spring-to-fall rate, the reverse of the seasonal relationship for the total group of white children.

In sitting height gains, the seasonal differences were not consistent for the three race groups, the white children showing a little higher rate in spring-to-fall than in fall-to-spring, while with the Mexican and negro races the fall-to-spring rate was the higher. Growth rates in sitting height were more variable as between boys and girls than were standing height rates.

The inconsistency in seasonal differences in average monthly rates of growth in height may be due to the very small numbers in the respective groups; yet it is also possible that seasonal differences in average monthly rate of growth in height may vary from year to year. But with seasonal differences of growth in height as small as in these data it seems more likely that among these children growth in height through the year was relatively more uniform than weight, or else marked differences may have been confined to shorter time intervals than those used in this study.

Table 23. Growth as shown by gains in standing height, sitting height, and weight made in consecutive fall-to-spring, and spring-to-fall intervals by the boys and the girls of the three race groups

Race	Sex	No. of cases	Gains, average per child													
			Standing height, inches					Sitting height, inches					Weight, pounds				
			Year Oct.'29-Oct. '30	Oct. '29-Mar. '30 5 months		Mar. '30-Oct. '30 7 months		Year Oct.'29-Oct. '30	Oct. '29-Mar. '30 5 months		Mar. '30-Oct. '30 7 months		Year Oct.'29-Oct. '30	Oct. '29-Mar. '30 5 months		Mar. '30-Oct. '30 7 months	
				Total	Av. per month	Av. per month	Total		Total	Av. per month	Av. per month	Total		Total	Av. per month	Av. per month	Total
White	Boys	105	2.05	0.87	0.175	0.169	1.18	0.93	0.37	0.074	0.080	0.56	6.55	3.21	0.64	0.48	3.34
	Girls	71	2.24	0.88	0.176	0.194	1.36	1.14	0.41	0.082	0.104	0.73	7.05	3.40	0.68	0.52	3.65
	Both	176	2.14	0.88	0.176	0.180	1.26	1.02	0.39	0.078	0.090	0.63	6.76	3.29	0.66	0.50	3.47
Mexican	Boys	53	2.10	0.88	0.176	0.174	1.22	0.80	0.40	0.080	0.057	0.40	7.33	3.42	0.68	0.56	3.91
	Girls	65	2.15	0.87	0.174	0.183	1.28	1.12	0.48	0.096	0.091	0.64	9.74	4.14	0.83	0.80	5.60
	Both	118	2.12	0.87	0.174	0.179	1.25	0.97	0.44	0.088	0.076	0.53	8.66	3.82	0.76	0.69	4.84
Negro	Boys	141	2.31	0.95	0.190	0.194	1.36	1.05	0.55	0.110	0.071	0.50	8.58	3.82	0.76	0.68	4.76
	Girls	147	1.90	0.78	0.156	0.160	1.12	1.00	0.52	0.104	0.069	0.48	7.52	3.75	0.75	0.54	3.77
	Both	288	2.10	0.86	0.172	0.177	1.24	1.03	0.54	0.108	0.070	0.49	8.03	3.78	0.76	0.61	4.25

Such disagreement as has been found between the seasonal variation in height increases of Groups A and B of this study exists between the findings of other workers with school children. Nylin (15) reported maximum weight increase in the same season as minimum height increase, and Orr and Clark (16) found maximum weight increments in July-September following maximum height increases in April-June; but Hitchings and Fitz (10) found that height increases were continuous through the year or that maximum rates of growth in height paralleled those of weight.

Age Groups

The children in group A of each sex in each race were divided into subclasses according to year of age to determine what relation age might appear to have to seasonal variation in growth. The Mexican age groups were regarded unsuitable for this further analysis because only two age groups of the boys and two of the girls contained more than 10 individuals, the greatest number being 21. The average gains per child for the year and the average monthly gain in standing and sitting height made in spring-to-fall and fall-to-spring are shown in Table 24 for the several age groups of boys and girls in the white and negro races. Calculations were not made for groups of fewer than 10 individuals.

The average monthly rates of gain in standing height for 4 of the 5 age groups of white girls and 1 of the 5 age groups of white boys, differed in the same direction as did the rates for the group of all ages. In the remaining 5 age groups the seasonal relations are reversed as compared with the all-ages group. Of 16 age groups of negro children, 4 of boys and 5 of girls show fall-to-spring rates less than spring-to-fall rates, thus resembling the group of all ages, while the remaining 7 age groups show an opposite seasonal relationship. The entire range of average monthly rates for white children is from 0.156 inch to 0.213 inch; for negroes 13 years of age and under, from 0.151 inch to 0.239 inch; for 14- and 15-year-old negroes, 0.050 to 0.076 inch. Any differences must be exceedingly small between spring-to-fall and fall-to-spring average monthly rates in a given age group and no definite and consistent seasonal variations among age groups are evident.

Rates of gain in sitting height are in the main about one-half that of standing height, and irregularity in direction of seasonal differences is common.

The seasonal differences in average monthly gains in weight are in favor of the fall-to-spring period, except for the 7-year-old white boys, the 10- and the 11-year-old negro girls, and the 11-year-old negro boys.

On the whole, the analysis of the data for the several age groups throws no additional light upon the question of seasonal variation of growth in height considered either alone or in connection with gains in weight.

Table 24. Growth as shown by gains in standing height, sitting height, and weight made in consecutive fall-to-spring, and spring-to-fall periods by children in the white and negro races grouped according to year of age

Race	Sex	Age, years	No. of cases	Gains, average per child								
				Standing height, inches			Sitting height, inches			Weight, pounds		
				Year Oct. '29-Oct. '30	Average per month		Year Oct. '29-Oct. '30	Average per month		Year Oct. '29-Oct. '30	Average per month	
					Oct. '29-Mar. '30 5 months	Mar. '30-Oct. 30 7 months		Oct. '29-Mar. '30 5 months	Mar. '30-Oct. 30 7 months		Oct. '29-Mar. '30 5 months	Mar. '30-Oct. 30 7 months
White	Boys	6	1									
		7	15	2.17	0.164	0.193	1.14	0.086	0.101	6.93	0.59	0.57
		8	20	2.08	0.176	0.171	1.00	0.064	0.097	6.20	0.58	0.47
		9	20	2.04	0.180	0.163	0.97	0.088	0.076	6.11	0.62	0.43
		10	22	1.96	0.174	0.156	0.84	0.072	0.069	5.93	0.66	0.38
		11	23	2.02	0.174	0.164	0.82	0.076	0.063	7.56	0.72	0.56
		12	4									
	Girls	6	4									
		7	14	2.17	0.158	0.197	1.12	0.072	0.109	5.20	0.50	0.39
		8	14	2.09	0.178	0.171	1.06	0.084	0.091	5.29	0.59	0.33
		9	17	2.25	0.178	0.194	1.15	0.080	0.107	7.61	0.74	0.56
		10	12	2.42	0.186	0.213	1.28	0.092	0.117	9.11	0.91	0.65
		11	10	2.23	0.176	0.193	1.05	0.084	0.090	7.89	0.68	0.64
Negro	Boys	7	7									
		8	11	2.20	0.176	0.189	0.97	0.102	0.066	5.06	0.42	0.42
		9	25	2.08	0.166	0.179	0.86	0.092	0.057	6.54	0.57	0.53
		10	12	1.88	0.164	0.151	0.69	0.086	0.037	5.10	0.56	0.33
		11	16	2.04	0.176	0.166	0.88	0.082	0.067	7.09	0.54	0.63
		12	16	2.26	0.172	0.200	0.96	0.094	0.070	8.87	0.64	0.81
		13	19	2.63	0.192	0.239	1.27	0.116	0.099	11.75	0.99	0.97
		14	18	2.81	0.254	0.220	1.41	0.156	0.090	11.90	1.27	0.80
		15	13	2.49	0.224	0.196	1.32	0.152	0.080	10.79	1.06	0.78
		16	4									
	Girls	6	1									
		7	4									
		8	16	2.14	0.162	0.190	0.93	0.108	0.056	5.89	0.55	0.45
		9	22	2.22	0.188	0.183	1.06	0.114	0.070	5.33	0.49	0.41
		10	13	2.51	0.176	0.233	1.21	0.096	0.104	8.03	0.65	0.68
		11	23	2.64	0.214	0.224	1.32	0.134	0.093	10.52	0.86	0.89
		12	18	2.10	0.168	0.180	1.25	0.118	0.094	11.33	1.15	0.79
		13	21	1.64	0.158	0.121	0.94	0.098	0.064	8.98	1.01	0.56
		14	15	0.75	0.076	0.053	0.52	0.066	0.027	4.38	0.66	0.15
		15	10	0.64	0.050	0.056	0.66	0.098	0.024	5.92	0.75	0.31
		16	3									
		17	1									

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SUMMARY AND CONCLUSIONS

Data in this project were collected with the cooperation of three public schools in San Antonio, each providing a representative population of approximately 500 pupils in one race—white, Mexican, or negro. Of this number, 324 white children, 277 Mexican, and 298 negro had complete weighing records for one or two years; 176 white, 118 Mexican, and 288 negro children, complete height records for one year; and 72 white, 35 Mexican, and 158 negro children, complete height records for two years. Only these complete records were used in analyzing the data for seasonal variation and distinctive racial differences in growth rates.

The average of yearly net gains in weight was 7½ pounds for the children of the white race and 8½ pounds for both the Mexican and negro children whose groups included slightly larger proportions of older individuals than did the white.

Evidence of seasonal variation of growth in weight was sought on the bases (1) of average net gains per child derived from group weights, (2) comparison of the contribution made by gainers and losers to the net monthly gain, (3) examination of the individual records of 98 pupils (42 white, 28 each of Mexican and negro) who showed no loss between any two consecutive weighings. The spring season included February, March, and April; the summer period extended from May through September; and fall included October, November, December, and January.

The results in all analyses show that race likenesses are much more pronounced and consistent than race differences. For all three races, fall was slightly the best season for gaining. The monthly gain in the four fall months averaged about 10 per cent of the entire yearly gain. Slight racial difference in seasonal variation was found in the relative

spring and summer rates of gain. The negro group had almost as high an average monthly percentage of the yearly gain in summer as in fall and a distinctly lower rate of growth in spring, while the white children had less difference than the negroes; the Mexicans' average monthly gain in summer more nearly resembled their fall gains in one year, but their spring gains in the other year. Among the three races, October was conspicuous for consistently excellent gains (from 11.3 per cent to 16.1 per cent of the yearly gain), and April, for uniformly poor gains (from 1.4 per cent to 6.4 per cent of the yearly gain). October gains for white children were about ½ as much as the gain in the preceding five summer months, for the Mexicans, 1/3 as much, and for two of the four negro groups, ¼ as much.

The variation between the three races, and within the Mexican race, in relative proportion of the yearly gain made in spring and in summer, suggests that some other factor (or factors) was exerting an effect upon rate of gaining weight, along with any biological phenomenon which tends to express itself in rhythmic seasonal variation. The small and irregular race differences can scarcely be attributed to inherent racial characteristics without elimination of all other factors that may influence growth, and such elimination cannot be made from the data of this study.

The records of individual monthly weight changes show that all three races have higher ratios of gainers to losers in fall months than in those of spring. In all three races, most average monthly gains made by the gaining group were near 1 to 1.25 pounds. The average amount of monthly loss was from 0.55 to 0.78 pound for all three races. Whatever factor (or factors) was more favorable to growth in fall than in spring months influenced the **proportion of children** who gained in weight, rather than the average **amount of weight** gained or lost. The chief racial difference found with individual monthly weight changes was in the ratio of gainers to losers, an average of approximately three times as many white and Mexican children gaining each month as losing, while only twice as many negroes gained as lost.

Approximately 2/3 of the individual records of the constant gainers agreed with the trends shown by the monthly weight changes and by the average net gains derived from group weights. However, it is evident that in many individual cases neither spring nor summer is incompatible with excellent growth, since 37 of 98 children had a higher rate of gain either in spring or summer than in fall. The records of individual children considered separately indicate that any natural impulse to rhythmic seasonal variation does not express itself uniformly for all individuals of any of the three races living in the same city and observed at the same time, or else this inherent tendency is overbalanced at one season or another by one or more other factors which influence the rate of growth. Each child should be regarded individually in his course of growth. A child's failure to gain should not be attributed complacently to the season of the year. Too much departure from regularity of gain

calls for special attention, although the degree of uniformity to be expected in normal growth must be determined by further study.

Seasonal variation of growth in weight appeared not to be influenced by sex, age, birth-month, type of body-build, or living conditions as indicated by the average number of rooms per person in the house and the presence or absence of a bathroom.

No explanation of the excellent gains made in October or the poor gains in April was afforded by examination of the records of weight changes in relation to the records (1) of food eaten for from two to four days within the weighing period, (2) of minor illnesses, especially colds, or (3) of climatic conditions as indicated by U. S. Weather Bureau records.

Average monthly gains in height, both standing and sitting, for both the entire group of each race and age groups of white and negro children show exceedingly small and negligible differences in spring-to-fall and fall-to-spring periods. Weight gains over the same periods, in contrast to height gains, show consistently a seasonal difference, being greater in the fall-to-spring than in spring-to-fall period. It appears from the data of this study that growth in height was relatively uniform through the year, or perhaps marked difference in rate was confined to shorter time intervals than those used in this study.

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